User's Manual Edition 4/2015

# NETWORK ACCESS UNIT

process
GAS CHROMATOGRAPHY

SIEMENS

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# Network Access Unit

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# Preface

**Audience & Purpose**

This manual provides installation personnel with instructions for proper and safe installation of the Network Access Unit (NAU).

# Technical Support

## Contacts for Help

Siemens provides support for the Maxum family of products worldwide. Contact information is provided on all Siemens products at the websites noted below.

This page provides contact information for Maxum System technical support, training, spare parts, and field service callout. Worldwide e-mail requests can be submitted 24 hours a day, 7 days a week. Service contracts can be established for direct remote phone service for products or for regular field service visits to the site.

When the analyzer is mounted and all of the connections are made, a specialist can be sent to assist you in starting up the equipment and preparing it for use. To schedule, contact Customer Service.

## To Contact Us:

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## Before You Call

When contacting Siemens Customer Service for installation technical assistance, the user will need to provide the unit serial number and a detailed description of the problem.

Indicate the installation problem encountered and provide any other information that will aid the customer service representative in correcting the problem.

## Safety Practices and Precautions

### Safety First

This product has been designed and tested in accordance with IEC Publication 1010-1, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the product in a safe condition.

### Terms in This Manual

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

### Terms as Marked on Equipment

DANGER indicates a personal injury hazard immediately accessible as one reads the markings.

CAUTION indicates a personal injury hazard not immediately accessible as one reads the markings, or a hazard to property, including the equipment itself.

### Symbols in This Manual

This symbol indicates where applicable cautionary or other information is to be found.

### Symbols Marked on Equipment

DANGER - High voltage

Protective ground (earth) terminal

ATTENTION - Refer to Manual

### Grounding the Product

A grounding conductor should be connected to the grounding terminal before any other connections are made.

## Correct Operating Voltage

Before switching on the power, check that the operating voltage listed on the equipment and the setting of the line-voltage selector switch agrees with the available line voltage.

## Danger Arising From Loss of Ground

Any interruption of the grounding conductor inside or outside the equipment or loose connection of the grounding conductor can result in a dangerous unit. Intentional interruption of the grounding conductor is not permitted.

## Safe Equipment

If it is determined that the equipment cannot be operated safely, it should be taken out of operation and secured against unintentional usage.

## Use the Proper Fuse

To avoid fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified in the parts list for your product. Use of repaired fuses or short circuiting of the fuse switch is not permitted.

## Safety Guidelines

DO NOT open the equipment to perform any adjustments, measurements, maintenance, parts replacement or repairs until all power supplies have been disconnected.

Only a properly trained technician should work on any equipment with power still applied.

When opening covers or removing parts, exercise extreme care since "live parts or connections can be exposed".

Capacitors in the equipment can retain their charge even after the unit has been disconnected from all power supplies.

# Chapter 1

# Network Access Unit

## Introduction

### Overview

The Network Access Unit (NAU) connects to our Advance Communications System (ACS) network to access operational information from any Maxum or Advance Optichrom Gas Chromatograph that is also connected to the ACS network. The NAU provides three basic functions:

- color touchscreen interface which maintenance personnel can use for remote control of chromatographs and other analyzers
- housing for electronic boards which supply input and output signals representing data in the analyzers
- serial digital connections to ASCII printers and/or to external HOST computers

These basic functions permit the NAU to be used for centralized maintenance access to a large number of chromatographs or other analyzers in a single process network and for centralized data input and output facilities, which are shared by many analyzers on a common network.

### I/O Options

The NAU provides space for up to 7 input/output boards.

The NAU ships with $I^2C$-controlled I/O boards, but also accommodates legacy CAN boards. (See *Legacy NAU Components* for details) Three types of boards are available.

**Available $I^2C$ I/O Boards:**

1. Analog I/O board (AIO_I2C): has 8 analog output channels, 8 analog input channels, and 2 digital input channels (See *Analog I/O Board (AIO_I2C) Connections* for details)
2. Digital I/O board (DIO_I2C): has 8 digital outputs and 6 digital inputs (See *Digital I/O Board (DIO_I2C) Connections* for details)
3. Analog and Digital I/O board (ADIO_I2C): has 4 digital outputs, 4 digital inputs, 4 analog outputs, and 4 analog inputs (See *Analog & Digital I/O Boards – I2C Bus* for details)

## Gas Chromatograph Portal Software

The Gas Chromatograph Portal (GCP) is the user interface workstation software that is used to communicate with and control various Siemens devices, including the Maxum and MicroSAM gas chromatographs, the Network Access Unit, and Optichrom Advance Plus.

The GCP consists of two primary executable software packages, the Network View window and the Analyzer View window. The Network View is used to view and manage multiple devices on the network. The Analyzer View window is the primary part of the GCP Workstation Software. It is used to manage, control, and configure individual devices.

## CEMS Software Option

The Continuous Emission Monitoring Systems (CEMS) software option for the NAU provides sample system control and general data acquisition for up to four Siemens continuous analyzers or most other analyzers or devices. When connected via our Advance Communications System (ACS) the NAU can be remotely accessed from the Maxum workstation. The CEMS option is described in Appendix 3, *CEMS Option*, of this manual.

## Specifications

| | |
|---|---|
| Dimensions | Rack Mounted Package Configuration<br>See Figure 1 for Outline Drawing and Dimensions<br><br>Wall-Mounted Package Configuration<br>See Figure 2 for Outline Drawing and Dimensions |
| Housing, Explosion Protection, Ratings and Certifications | Wall Mounted Configuration<br>CSA Certified for Class I, Division 2, Group A,B,C,D<br>European Union non-hazardous area (non-Ex)<br><br>Rack Mounted Configuration<br>CSA Certified for Class I, Division 2, Group A,B,C,D<br>European Union non-hazardous area (non-Ex)<br><br>Electromagnetic and Radio Frequency Compatibility and Electrical Safety<br>CE Compliance; certified to 89/336/ECC (EMC directive)<br>CE Compliance; certified to 73/23/EEC (Low Voltage directive)<br>Tested per EN 61010-1 / IEC 1010-1<br><br>Housing Materials<br>Stainless steel (1.4016)<br><br>Weight<br>Rack/Wall: 15 kg (35 pounds) approximately |
| Ambient Installation Conditions | Operation: -18° to 50°C (0° to 122°F)<br><br>0-99% relative humidity (non-condensing) maximum<br>0-75% relative humidity year-round average<br>(Purge with dry air or nitrogen if required in tropical conditions.)<br><br>Must not be exposed to direct sunlight.<br>Must be protected from rain.<br><br>Storage and Transport: -25° to 65°C |
| Power | Nominal: 115VAC / 230VAC (field switchable)<br>Tolerance: 85-140VAC or 185-250VAC; 47-63Hz<br>300W<br><br>Power line protection: G fuse element per IEC 127-2, 4A rating, slow-blow<br><br>Power wiring in field made to screw terminals on two-part connectors;<br>SYSCON2.1 I/O: 16AWG (1.5mm$^2$) or smaller power wiring<br>I/O boards: 18AWG (1.0mm$^2$) or smaller power wiring<br>Must conform to local installation codes and requirements. If conformance to CE certified installation requirements is required, power cable must be shielded or installed in conduit. |

Input and Output Capacity

Standard Built in I/O
2 Isolated Analog Outputs (1 can be assigned for chromatogram output)
4 Digital Inputs
4 Digital Outputs (1 indicates system error; 3 are user-configurable)
Serial Outputs RS-485, RS-232

Optional I/O Boards
I2C AIO:8 analog inputs, 8 analog outputs, 2 digital inputs
I2C DIO: 6 digital inputs, 8 digital outputs
I2C ADIO:4 analog inputs, 4 analog outputs, 4 digital inputs, 4 digital outputs

Note: The NAU is also compatible with original version CAN bus I/O from Siemens. CAN I/O boards have lower I/O channel count and capacity. See *Legacy NAU Components.*

Input and Output Specifications

Digital Outputs (ADIO, DIO, and SYSCON2.1)
Floating double-throw contacts, maximum contact load rating 1A (I/O Expansion Boards) or 2A (SYSCON2.1 I/O) at 30V (AC or DC). External diode shunt suppression should be used for inductive DC loads, preferably at the load.

Digital Inputs (ADIO, AIO, DIO, and SYSCON2.1)
Optically coupled with a common for all inputs. Self-powered floating-contact input, or configurable for sinking or sourcing current. A switch mounted on the board select either sinking (Mode 2, default), or sourcing (Mode 1, legacy) for the digital inputs.

Sourcing current mode: 24V internal isolated supply, with positive terminal of supply at common.

Sinking current mode: 5V internal isolated supply, with negative terminal of supply at common.

Analog Outputs (ADIO, AIO, and SYSCON2.1)
0/4 to 20mA into 750Ω maximum, common negative pole, galvanically separated from ground, freely connectable to ground.

Analog Inputs (ADIO and AIO)
Each input configurable for current or voltage; -20 to 20mA into 50Ω or -10 to 10V with 100kΩ input resistance, fully differential. Each differential channel operates within the range of -100 to 100V common mode to chassis ground.

Serial Ports
Four serial ports, each configurable as either RS-232 or RS-485.

Ports may be used for data logging printer or for connection to an external Host computer such as a DCS system. Protocols for connection to an external computer include Modbus and are described in a separate document.

Power Connections
Power wiring; IEC 60320-1 C14 connector; must conform to local installation codes and requirements. If conformance to CE certified installation requirements is required, power cable must be shielded or installed in conduit.

Network Connections
Ethernet: 8-pin RJ45 plugs or optional ST fiber connector.

Serial Digital Input and Output Connections
9-pin Sub-D plugs (male provided on unit) configurable for RS-485 or RS-232

Discrete Analog and Digital Input and Output Connections
Standard built-in I/O: 2 12-pin two-part screw terminal connectors
Optional plug-in I/O boards: 1 36-pin (legacy CAN boards use 22-pin) two-part screw terminal connector per board.

Note:
All SYSCON screw-terminal connectors used on I/O field wiring accept 16AWG ($1.5mm^2$) or smaller stranded or solid copper wire. $I^2C$ I/O cards accept 18AWG ($1.0mm^2$) wire.

**Physical Dimensions**

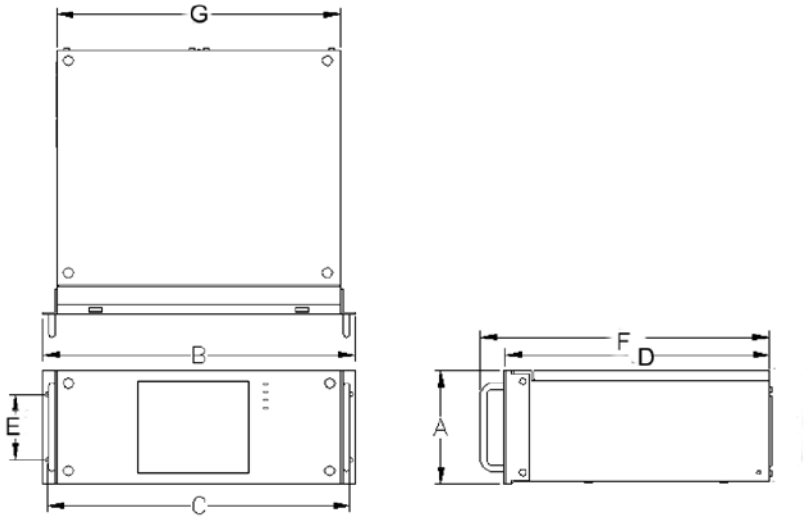



**Figure 1. Rack Mount Dimensions**

| 0 | Description | U.S. Inches | Metric mm |
|---|---|---|---|
| A | Rack Height | 6.97 | 177 |
| B | Rack Total Width | 19 | 483 |
| C | Rack Mounting Holes Spacing | 18.43 | 468 |
| D | Rack Depth Case Only | 16.26 | 413 |
| E | Rack Handle | 6.83 | 174 |
| F | Rack Depth with Handles | 17.63 | 448 |
| G | Case Width | 17.32 | 440 |

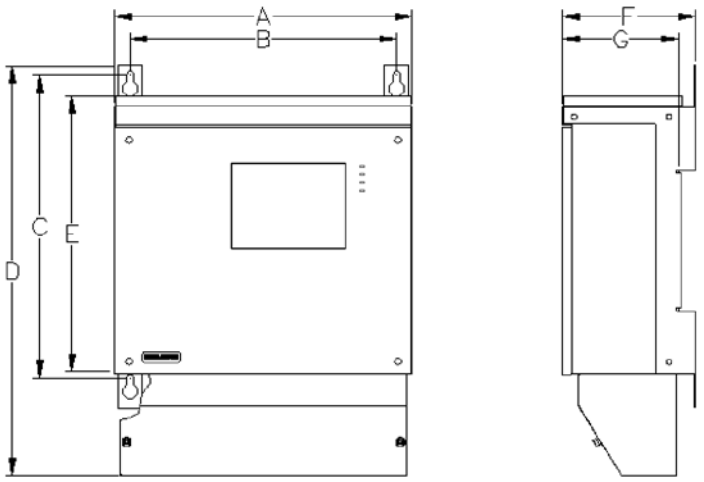



**Figure 2. Wall Mount Dimensions**

| Figure 2 | Description | U.S. Inches | Metric mm |
|---|---|---|---|
| A | Wall Width | 17.48 | 444 |
| B | Wall Mount Holes Horizontal Spacing | 15.59 | 396 |
| C | Wall Mount Holes Vertical Spacing | 17.72 | 450 |
| D | Wall Height Including Cable Housing | 24.04 | 611 |
| E | Wall Height w/o Cable Housing | 16.32 | 415 |
| F | Wall Mount Total Depth | 7.81 | 199 |
| G | Wall Mount Depth Case Only | 6.91 | 176 |

# Chapter 2

# Installation

## Overview

This chapter is intended for installation and maintenance personnel.

All factory-installed I/O Modules have been pre-configured for correct addressing and other system setup. To ensure a safe and trouble free installation, follow all procedures and associated advisory information.

### Read This

If a circuit board is found to be faulty and needs to be replaced, contact Siemens Customer Support.

### Installation Hint

It is highly recommended that the user thoroughly read through this Chapter to establish an installation plan. Before beginning the unpacking and installation process, read the wiring and illustration diagrams supporting installation procedures.

### Major NAU Components

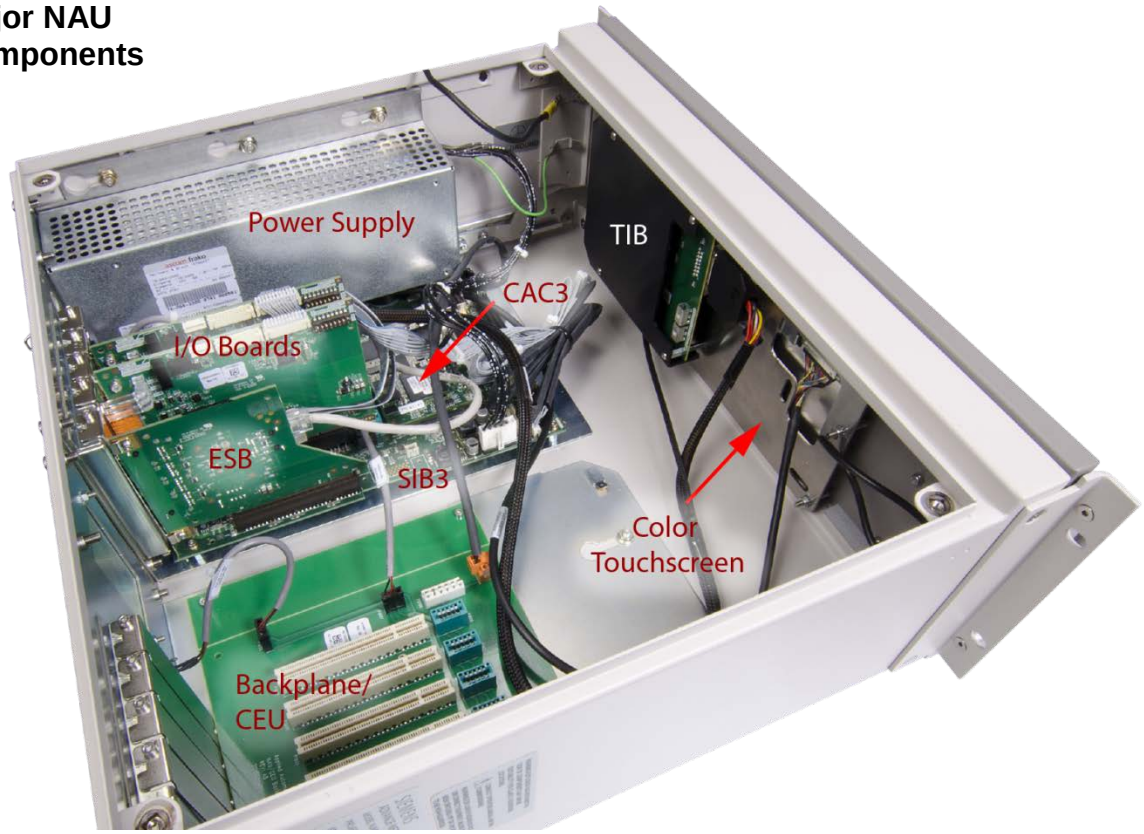



**Figure 3. NAU Interior Components (Rack unit, wall unit similar)**

# Unpacking and Inspection

## Description

This section provides the steps to follow when receiving and unpacking the Network Access Unit (NAU).

## Receipt of NAU

When NAU is received, examine the shipping container for evidence of external damage. Outside damage may be an indicator of damage to the NAU. Record any external damage.

## Unpacking

Open the carton containing the NAU and remove all internal and packing material. Carefully remove the unit from the carton and inspect it for damage that may have occurred during transportation. Carefully examine shipped contents with those listed on the Bill of Lading. All items should match those on the Bill of Lading.

Perform the following inspections:

- Inspect NAU exterior for dents, chipped paint, scratches etc.
- Open NAU top cover (on rack-mount units) or front door (on wall-mount units) and visually inspect interior mounted assemblies, connectors and any installed boards.
- If NAU is to be rack or wall mounted, be certain the proper mounting hardware is provided.
- Inspect installed I/O field wiring connectors and wire openings. There must not be any damage to these connectors. Damaged connectors will impair NAU operation.
- Check internal power supply AC power connector and voltage selector switch for damage.

## Reporting Damage

If there is any evidence of damage to the shipping carton or the NAU, file a damage report with the carrier and notify your local Siemens representative. Keep all shipping materials as evidence of damage for carrier's inspection. Immediately contact your representative who will arrange for immediate repair or replacement. The Customer Service department can be contacted as follows:

Inside Oklahoma: 918-662-7030
Outside Oklahoma: 800-448-8224 (toll free)
Internationally: 001-918-662-7030

# Wall or Rack Mounting Installation

## Instructions

The Network Access Unit (NAU) should be:

- Installed in a location that is as free from shock and vibration
- Protected from direct sunlight and extreme temperatures.
- It is recommended that the NAU be mounted within a shelter. This prevents NAU from being exposed to outside environmental conditions.

## Package Configurations

The NAU is available in two models;

- Wall mount unit
- 19-inch rack unit

## Wall Mounting

The mounting wall must be capable of supporting the weight of the **NAU**; see *Specifications*.

**Wall Mount Unit**: Use four, 5/16-inch (M8) or 3/8-inch (M10) lag bolts to mount the NAU to the wall. Mounting bolts must be secured to solid wall construction members such as studs and into the wall only. Allow adequate clearance on the left side to allow the door to swing open.

## Optional Conduit Connection Box

If your wall mounted NAU unit has a Conduit Connection Box, holes must be drilled into the side or bottom of the box to accommodate compression fittings, cable glands, or conduit fittings.

## Routing Cables

Cable routing and entry must be done in accordance with the local safety practices and regulations.

Always use the correct sized compression fitting for the size cable being run. Alternatively, all cabling may be installed in conduit, which is fit or adapted to the safe wiring box as required in the field.

# NAU SYSCON2.1 Connections

## Description

This section shows differences in connections between the NAU System Controller (SYSCON, described in Appendix 4, *Legacy NAU Components*) and version 2.1 of the System Controller (SYSCON2.1).

In this document, “SYSCON2.1” refers to the System Interface Board, version 3 (SIB3) with the Control and Communication Board, version 3 (CAC3) mounted on it.

The primary difference between original SYSCON and SYSCON2.1 is that there are four serial ports on the SYSCON2.1 that are each configurable for either RS-232 or RS-485. In addition, there are four external Ethernet connections in the SYSCON2 compared to one in the original SYSCON.

The RS-485 port differs between the original SYSCON and the SYSCON2.1. All serial connectors are male (compared to female for the RS-485 port in the original SYSCON). Pinout of the connector when configured as RS-485 is shown in the *Communication Connections: RS-232C or RS-485* section.

The connections to the NAU SYSCON2.1 are shown below. Applicable I/O connection diagrams are shown on the following pages.

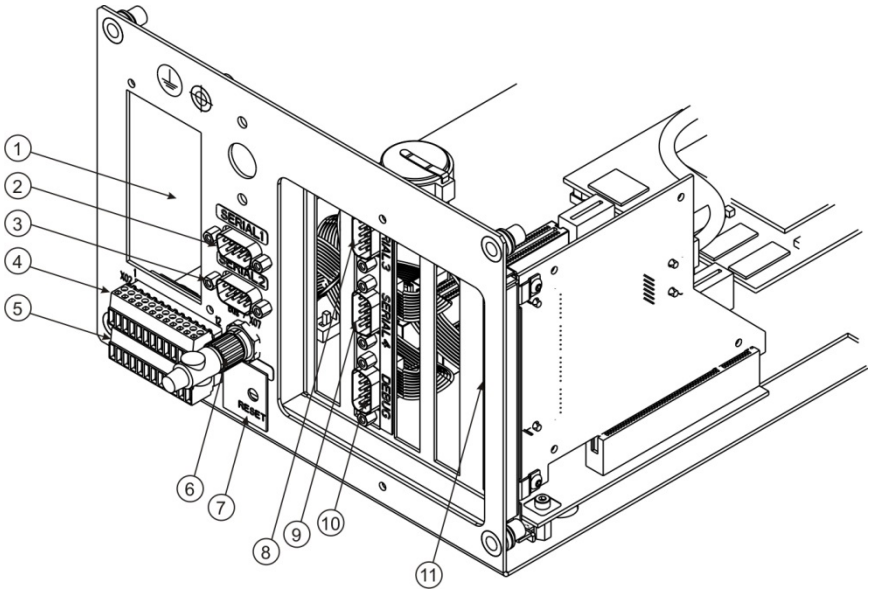



**Figure 4. NAU Connectors**

| | | | |
|---|---|---|---|
| **1** | 115 VAC or 230 VAC power supply | **7** | SYSCON2.1 Reset |
| **2** | Serial Port 1 (Modbus) | **8** | Serial Port 3 |
| **3** | Serial Port 2 (e.g. Printer) | **9** | Serial Port 4 |
| **4** | Digital outputs (system controller) | **10** | SYSCON2.1 Debug |
| **5** | Analog outputs and digital inputs (system controller) | **11** | Ethernet Switch Board (External Ethernet) |
| **6** | System bus for add-on CAN Extension Unit | **Other** | Slots 1, 3, 4 (counting from left) analog and digital I/O boards |

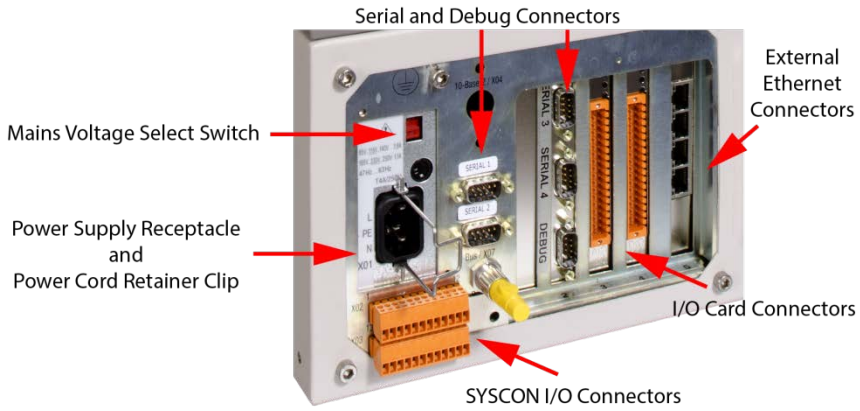

Serial and Debug Connectors
External Ethernet Connectors
Mains Voltage Select Switch
Power Supply Receptacle and Power Cord Retainer Clip
I/O Card Connectors
SYSCON I/O Connectors

**Figure 5. Rear Panel Connections (Rack shown, Wall similar)**

## AC Power (Mains) Connections

### Description

The NAU power supply requires an input voltage of 115VAC or 230VAC.

### Specifications

| | |
|---|---|
| Input Voltage | 85 - 140VAC or 185 - 250VAC<br>47 - 63Hz |
| Output Voltage | 24VDC ±5% |
| Input Current | max. 2.5A at 115VAC, max.<br>1.25A at 230VAC |
| Power Consumption | Approximately 200VA |
| Fuse | G fuse element per IED 127 2, 4A rating, slow-blow for both 115VAC and 230VAC |
| Line Power connection | 3-pin grounded instrument connector per IEC 60320 |

**CAUTION**

⚠

Follow all applicable national, state and local safety regulations for the installation and operation of the NAU.

### Connecting AC Power

Primary AC power can be directly connected to the internal NAU power supply connector from an AC wall outlet in close proximity to the NAU.

### Wall Mounted Unit with Conduit Connection Box

Cables must be run through compression fittings, cable glands, or conduit fittings that are appropriate for the wiring installed in the bottom or side of the Conduit Connection Box. When the compression fitting is tightened, it secures the cable and prevents it from being pulled out from its connector.

## Installing AC Power

The following procedures should be followed for connecting primary AC wiring to the NAU.

**Procedures**

1. Turn off primary AC power to this location.
2. If unit is equipped with conduit connection box go to step 3. If not perform this step and go to step 6.
3. Remove wiring access plate. Punch holes as required for either conduit or cable gland connectors. Install connectors and replace the plate.
4. Wall Mounted Units with Conduit Connection Box. Remove the Conduit Connection Box cover by loosening the 2 fastening screws.

5. Wall Mounted Units with Conduit Connection Box. Drill holes in side of box to accommodate conduit or cable gland connectors. If desired, entry can be made from underside of Conduit Connection Box.
6. Route input power cord, in accordance with pertinent electrical codes and regulations to the NAU power supply.
7. A separate ground connection point, marked with a ground symbol, is provided near the AC-input receptacle. Connect a ground wire to this location. After connecting ground wire, securely tighten mounting screw.
8. Set the 115/230VAC voltage selector switch to be compatible with the primary AC voltage; see Figure 4 and Figure 5.
   Connect the power cord to the power supply receptacle and secure it with the clip; see Figure 4 and Figure 5.
   Wall Mounted Unit with Conduit Connection Box. Open the front Conduit Connection Box cover, and ensure that the internal ground strap is securely tightened. This ground strap grounds the cover to the Box which is then grounded to the NAU. This strap MUST NOT be disconnected.
9. Primary AC power can now be applied to the NAU.

## Communication Connections: Ethernet

### Description

The NAU is equipped with a SYSCON2.1 which includes an Ethernet Switch Board (ESB). A short Ethernet cable connects the two units as shown in the photo at right. The ESB provides external connection ports.

### External Ethernet Connectors

See Figure 5 for the location of the external Ethernet connectors. To access connectors in wall mounted units, the Conduit Connection Box cover must be removed.

### External Ethernet Data Cable

The external Ethernet data cable requires a minimum of two twisted pairs, one pair for transmission and the other for receiving. The cable should conform to the following specifications:

| Function | Specifications |
|---|---|
| Data Rate | 10 or 100 Mbits/sec autonegotiating |
| Maximum Cable Length | 328 feet (100 meters) |
| Cable Requirements | Category 3 or 5 Ethernet cable (CAT5e recommended for maximum flexibility) |

**NOTE**

The maximum length of Ethernet cable cannot exceed 328 feet (100 meters). To increase this distance, the cable must be connected to some type of repeater/medium converter such as an Ethernet switch or router.

### Data Cable Termination

A male RJ-45 connector is required on the end of the Ethernet cable. The following table shows the RJ-45 wiring connections.

| Pin No. | Function |
|---|---|
| 1 | T+ |
| 2 | T- |
| 3 | R+ |
| 4 | NC |
| 5 | NC |
| 6 | R- |
| 7 | NC |
| 8 | NC |

## Ethernet Switch Board (ESB)

The primary external communication for the SYSCON2.1 is via Ethernet link. The CAC3 has an on board 10/100 Ethernet controller. This is connected via a short RJ-45 patch cable to the Ethernet Switch Board (ESB) that resides on the SIB3. The ESB converts the single CAC3 Ethernet into four Ethernet connections and manages traffic among them.

The ports on the ESB are auto-negotiating for either 10BaseT or 100BaseT operation. The Ethernet Switch is plug-and-play as it does not require initial setup or configuration.

The ESB is equipped with a jumper setting, R2, located in the lower right portion of the board. For proper field operation this jumper should be set to default position, 2-3 (or the jumper can be removed for default operation as well). There are several LEDs equipped on the Ethernet Switch. These identify the operating speed of each port as indicated in the following table.

**Table 2-1**
**ESB LEDs**

| LED | Meaning | Meaning/Designation |
|---|---|---|
| 1 | On=100Mb Off=10Mb | Internal RJ-45 Connector to CAC3. |
| 2* | On=100Mb Off=10Mb | External Top RJ-45 Connector |
| 3* | On=100Mb Off=10Mb | External Second RJ-45 Connector |
| 4* | On=100Mb Off=10Mb | External Third RJ-45 Connector |
| 5* | On=100Mb Off=10Mb | External Bottom RJ-45 Connector |
| *Note: LEDs for external connectors count from the bottom up (e.g. bottom LED is for top connector). | | |

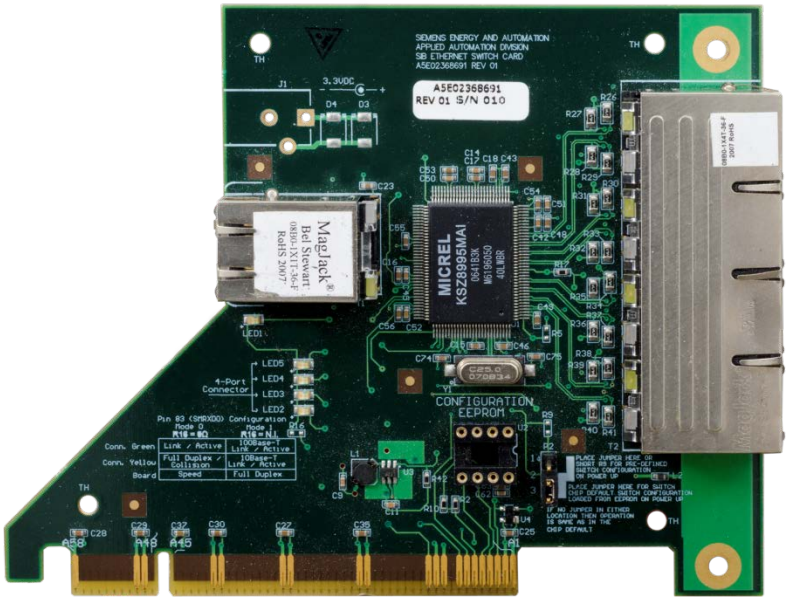



**Figure 6. Ethernet Switch Board (ESB)**

Two LEDs are visible on each RJ-45 connector.

- Solid yellow LED: Full-duplex link
- Occasionally-flashing yellow LED: Collisions on half-duplex link
- Flashing green LED: Link activity

## Ethernet Switch Board with Fiber (ESBF)

The Ethernet Switch Board with Fiber (ESBF) is similar to the Ethernet Switch Board (ESB) described previously. The primary difference is that for the ESBF one of the 10/100Base-T connectors has been replaced with a 100Base-FX 1300 nm fiber optic connection with duplex ST™ connectors. This fiber connection is not compatible with 10 megabit fiber systems.

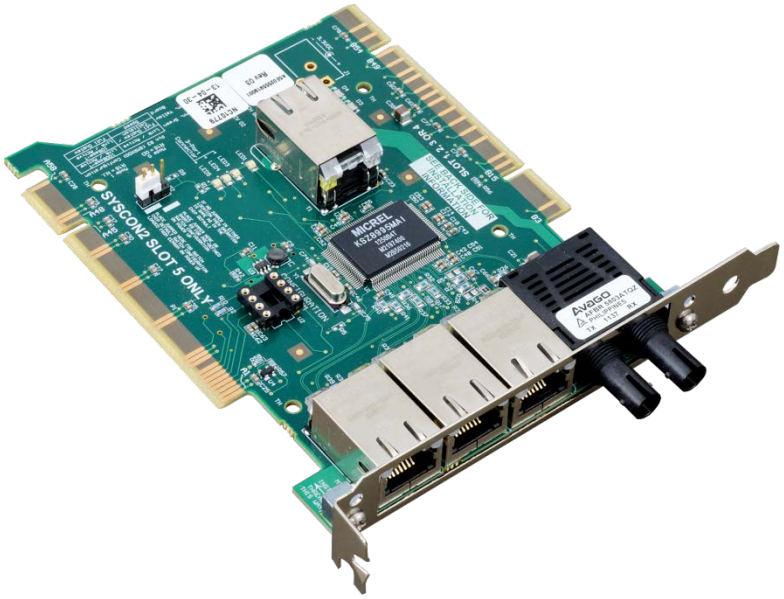



**Figure 7. Ethernet Switch Board with Fiber (ESBF)**

More information on the ESBF is in the *Maxum II Maintenance Manual* 2000596

## Communication Connections: RS-232C or RS-485

### Description

This section provides information for making connections to the NAU installed SYSCON RS-232C and RS-485 serial port connectors. See Figure 4 and Figure 5 for connector locations.

### Wall Mounted Unit Cable Compression Fittings

Cables must be run through compression fittings installed in the bottom or side of the Conduit Connection Box. When the compression fitting is tightened, it will secure the cable and prevent it from being pulled out from its SYSCON connector. The compression fitting openings that are drilled into the box must be suitable for the size cables being run.

The maximum line length is 3937 feet (1200 meters) for RS-485 and 49 feet (15 meters) for RS-232.

### Serial Port Cable Installation

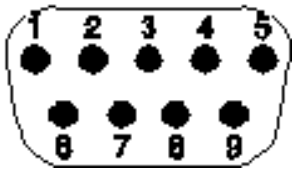
The following procedures should be followed when installing serial port data cable:

***Procedures***

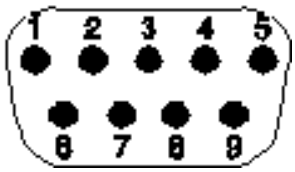
1. Before installing RS-232 and/or RS-485 connector(s), turn NAU AC power OFF.
2. Feed serial cable through the compression fitting, leaving sufficient cable length within the Conduit Connection Box, leave enough cable to allow connecting of RS-232C and/or RS-485 connector and to remove cable tension; tighten fitting.
3. Plug RS-232-C and/or RS-485 connector in appropriate SYSCON serial port connectors (for SYSCON2, refer to the database to determine which connectors are configured as RS-232 and which are RS-485).
4. Turn NAU AC power ON.

## Cable Connections

Refer to the following Tables for RS-232C and/or RS-485 connector wiring configurations if constructing a cable.




| | RS-485 Serial Connections | |
|---|---|---|
| **Pin No.** | **Function (original SYSCON)** | **Function (SYSCON2)** |
| 1 | NC | NC |
| 2 | RTxD- (RS-485B) | 5 V Power |
| 3 | RTxD+ (RS-485A) | RTxD+ (RS-485A) |
| 4 | NC | NC |
| 5 | GND | GND |
| 6 | NC | NC |
| 7 | NC | NC |
| 8 | NC | RTxD- (RS-485B) |
| 9 | NC | NC |
| Connector Type | Female | Male |




| RS-232 Serial Connections | |
|---|---|
| **Pin No.** | **Function** |
| 1 | DCD |
| 2 | RxD |
| 3 | TxD |
| 4 | DTR |
| 5 | GND |
| 6 | DSR |
| 7 | RTS |
| 8 | CTS |
| 9 | RI |

# I/O Board Wiring Connections

## Description

This section is intended for installation personnel and contains instructions for making external connections to the I/O Modules.

**CAUTION**

Follow local regulations on installing and connecting electrical wiring.

Locate the signal control and interface lines separately from the power supply line.

Route the analog and digital leads separately.

## Material Required

Selection of the required wire gauge depends on:

- Line Length
- Planned Current Load

The maximum conductor section is 1.0mm$^2$, or 18AWG.

The matching plug-in field wiring connectors for each I/O board are supplied with the unit. All wiring connections are made to these connectors, which plug into each I/O board.

## CE Installations

Required for all CE (Conformité Européean) installations.

The user must determine if the heavy industrial conducted immunity requirements are pertinent to the installation and application. If the requirements are pertinent then:

- All Digital Output (DO) lines with inductive loads must have transient suppression at the inductive load.
- All Analog Output (AO) lines must be terminated in a load that is CE/EMC certified to meet the heavy industrial conducted immunity requirements. All other CE requirements are met with standard/normal termination.

The newest version of I/O board connects to an I$^2$C bus. The I$^2$C I/O boards are the version generally available for new installation.

Proceed as follows to connect the signal, control and interface wiring to the NAU installed I/O boards.

**Wall Mount Units**

Carefully plan the arrangement of the signal lines in the cables as well as the use of safety box connector openings.

1. Before installing cable, turn NAU AC power switch OFF.
2. Feed cable through the compression fitting, leaving sufficient cable length within the Conduit Connection Box. Leave enough cable to allow connection of cable connector and to remove cable tension; tighten fitting.
3. Make all wiring connections to the I/O board plug-in field wiring connector in accordance with the applicable wiring diagram; see *NAU SYSCON2.1 Connections*. Ensure that the screw lug for each connection is securely tightened.
4. Plug the field wiring connector into correct I/O board.
5. Turn NAU AC power ON

**Rack Mount Units**

1. Before installing cable, turn NAU AC power OFF.
2. Make the wiring connections to the I/O board plug-in field wiring connector in accordance with the applicable wiring diagram; see *NAU SYSCON2.1 Connections*. Ensure that the screw lug for each connection is securely tightened.
3. Plug the field plug-in connector into correct I/O board.
4. Turn NAU AC power ON.

## Location of Fault LEDs

Observing the installed board(s) from rear of NAU, status LEDs are numbered sequentially starting with #1 LED being at the upper edge of board. LEDs are located behind installed board field wiring connectors; see Figure 8.

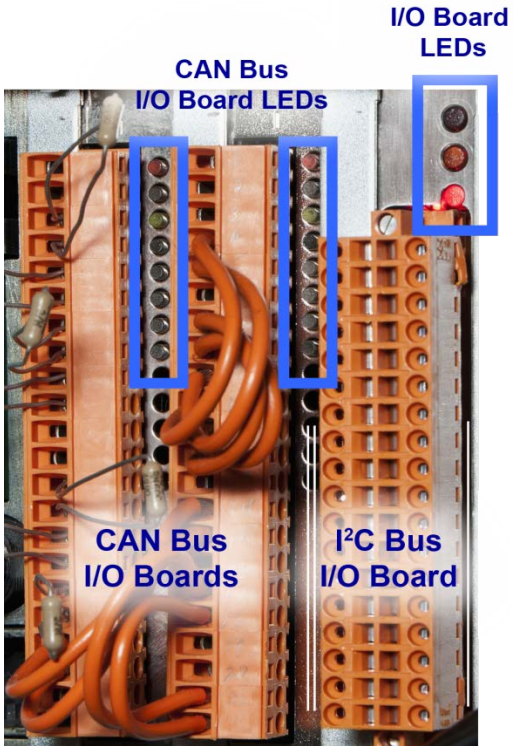



**Figure 8. NAU Status LED Location**

One $I^2C$ I/O board is shown on the right. $I^2C$ Boards have 3 LEDs to indicate Normal (green), Warning (yellow) or Fault (red) conditions. The Normal LED may flash to show active communication.

Two legacy CAN boards are shown to the left. These boards have a number of additional status LEDs, described in *CAN I/O Board Information*.

# I²C Board I/O Connections

## Analog & Digital I/O Boards – I²C Bus

The newest version of I/O board connects to an I²C bus. The I²C I/O boards are the version generally available for new installation. See the specific subsections for each I/O board later in this section for connection diagrams information.

- Analog I/O board (AIO_I2C): has 8 analog output channels, 8 analog input channels, and 2 digital input channels
- Digital I/O board (DIO_I2C): has 8 digital outputs and 6 digital inputs
- Analog and Digital I/O board (ADIO_I2C): has 4 digital outputs, 4 digital inputs, 4 analog outputs, and 4 analog inputs

The DOs are rated for 1A resistive load. Inductive loads are different. A DO should not drive an inductive load greater than 0.5A. An example is the typical block-and-bleed application which uses two parallel solenoids at 0.4A each. Separate DOs should be used to drive each solenoid. Each DO connected to a solenoid should have a diode to suppress the solenoid load.

### *Additional I/O Boards*

The SYSCON supports up to two I²C I/O boards. These boards provide approximately twice the number of circuits as previous CAN I/O boards.

### *I²C I/O Board DI Mode Switch*

For the I²C I/O boards that contain digital inputs (DIs) switch SW1 located at the top of the board near the front (connector end) controls the mode setting for the on-board DIs. (See Figure 9). The switch sets the mode for all DI circuits on the board (mixing of modes on a board is not allowed). The available options are Default/Sink and Legacy (see back side of board for diagram of setting). The Legacy option is designed to adjust for a non-standard configuration that may be in use on some systems. The Mode switch should be set to Mode 2 unless instructed differently by Siemens.

### *I²C I/O Board Status LEDs*

Three status LEDs have been included on each I²C I/O board. These LEDs are visible on the top front of the board. The LEDs follow the Maxum standard as follows:

- LED3 (Norm) - The top (green) LED indicates that the board is powered when lit. When this is the only LED illuminated, then the board is operating normally.
- LED2 (Warn) - When lit, the middle (yellow) LED indicates that there is a warning status for the board.
- LED1 (Fault) - When lit, the bottom (red) LED indicates that the board has a fault.

### *I²C Bus Connections on I²C I/O Boards*

There are two standard I²C bus connections on the top of each I²C I/O board. Either of these connections may be used as either a bus input or bus extension connection. In this manner the I²C bus can daisy-chain from one board to another or to other I²C devices.

### *I²C I/O Board Address DIP Switches*

The I²C I/O boards use an 8-bit board identification number as an address on the I²C bus. The address is a hex number from 00 to FF, corresponding to a decimal number from 0 to 255. Address numbers from 1 to 254 are used (numbers 0 and 255 are reserved).

DIP switches are used to set the address for the physical board as shown in Figure 9. When replacing a board, the user only needs to set the switches on the new board to match the old board being replaced.

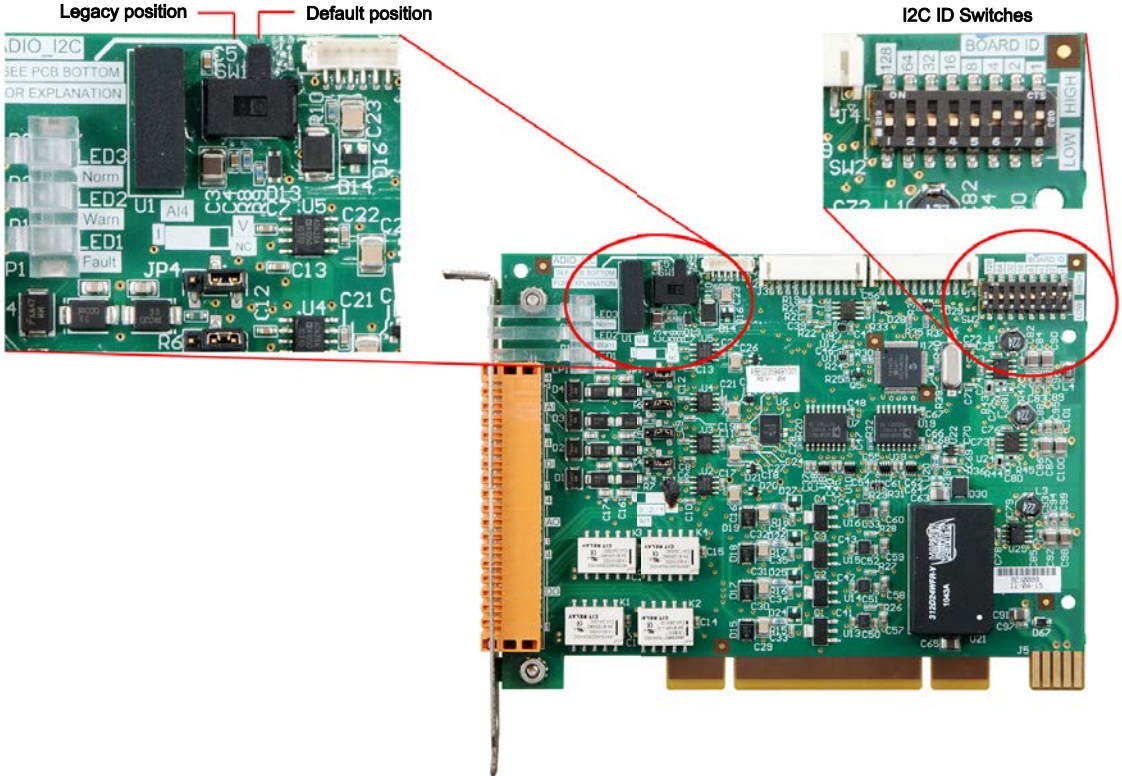



*Figure 9. I²C I/O Address Switches*

The DIP switches used to set the address are on the top back part of the board and are labeled BOARD ID. Together, the DIP switches correspond to an 8 bit binary number that is set to match the board address. Each switch is labeled for the binary digit it represents, and setting a switch is equivalent to setting that bit to 1. For example, if the switches for 1, 2, and 4 are set, then the board ID would be 1+2+4 = 7.

## Analog I/O Board (AIO_I2C) Connections

Circuits on the AIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

| AIO I2C Wire Side View | | | | | |
|---|---|---|---|---|---|
| **Lead** | **Pin** | | | **Pin** | **Lead** |
| AI8 -10V | 2 | ∎ | ∎ | 1 | AI8 +10V |
| AI7 -10V | 4 | ∎ | ∎ | 3 | AI7 +10V |
| AI6 -10V | 6 | ∎ | ∎ | 5 | AI6 +10V |
| AI5 -10V | 8 | ∎ | ∎ | 7 | AI5 +10V |
| AI4 -10V | 10 | ∎ | ∎ | 9 | AI4 +10V |
| AI3 -10V | 12 | ∎ | ∎ | 11 | AI3 +10V |
| AI2 -10V | 14 | ∎ | ∎ | 13 | AI2 +10V |
| AI1 -10V | 16 | ∎ | ∎ | 15 | AI1 +10V |
| AO_GND | 18 | ∎ | ∎ | 17 | AO8 Current |
| AO_GND | 20 | ∎ | ∎ | 19 | AO7 Current |
| AO_GND | 22 | ∎ | ∎ | 21 | AO6 Current |
| AO_GND | 24 | ∎ | ∎ | 23 | AO5 Current |
| AO_GND | 26 | ∎ | ∎ | 25 | AO4 Current |
| AO_GND | 28 | ∎ | ∎ | 27 | AO3 Current |
| AO_GND | 30 | ∎ | ∎ | 29 | AO2 Current |
| AO_GND | 32 | ∎ | ∎ | 31 | AO1 Current |
| DI Common | 34 | ∎ | ∎ | 33 | DI2 Signal |
| DI Common | 36 | ∎ | ∎ | 35 | DI1 Signal |

**Analog Inputs:** -20 to 20mA into 50Ω or -10 to 10V, $R_{10}$=1MΩ, mutually isolated 10V

**Analog Outputs:** 0/4-20mA. Common negative pole, galvanically separated from ground, freely connectable to ground; working resistance 750Ω.

**Digital Inputs:** Optocoupler with internal 12-24VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24VDC, common negative pole.

**Design:** Terminal strips for stranded or solid conductors with a maximum diameter of 1.0$mm^2$ or 18AWG.

*Figure 10. $I^2C$ AIO Board Connection Diagram -X10 - -X11*

## Digital I/O Board (DIO_I2C) Connections

Circuits on the DIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

| DIO I2C Wire Side View | | | | | |
|---|---|---|---|---|---|
| **Lead** | **Pin** | | | **Pin** | **Lead** |
| DI Common | 2 | ∎ | ∎ | 1 | DI6 Signal |
| DI Common | 4 | ∎ | ∎ | 3 | DI5 Signal |
| DI Common | 6 | ∎ | ∎ | 5 | DI4 Signal |
| DI Common | 8 | ∎ | ∎ | 7 | DI3 Signal |
| DI Common | 10 | ∎ | ∎ | 9 | DI2 Signal |
| DI Common | 12 | ∎ | ∎ | 11 | DI1 Signal |
| DO8 C | 14 | ∎ | ∎ | 13 | DO8 NC |
| DO7 NC | 16 | ∎ | ∎ | 15 | DO8 NO |
| DO7 NO | 18 | ∎ | ∎ | 17 | DO7 C |
| DO6 C | 20 | ∎ | ∎ | 19 | DO6 NC |
| DO5 NC | 22 | ∎ | ∎ | 21 | DO6 NO |
| DO5 NO | 24 | ∎ | ∎ | 23 | DO5 C |
| DO4 C | 26 | ∎ | ∎ | 25 | DO4 NC |
| DO3 NC | 28 | ∎ | ∎ | 27 | DO4 NO |
| DO3 NO | 30 | ∎ | ∎ | 29 | DO3 C |
| DO2 C | 32 | ∎ | ∎ | 31 | DO2 NC |
| DO1 NC | 34 | ∎ | ∎ | 33 | DO2 NO |
| DO1 NO | 36 | ∎ | ∎ | 35 | DO1 C |

**Digital Inputs:** Optocoupler with internal 12-24VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24VDC, common negative pole.

**Digital Outputs:** Digital Outputs: Floating double-throw contacts, max. contact load rating 30V/1A

The DOs are rated for 1A resistive load. Inductive loads are different. A DO should not drive an inductive load greater than 0.5A. The typical block and bleed application, which uses two parallel solenoids at 0.4A each, should use separate DOs to drive each solenoid. Each DO connected to a solenoid should have a diode to suppress the solenoid load.

**Design:** Terminal strips for stranded or solid conductors with a maximum diameter of 1.0mm$^2$ or 18AWG.

*Figure 11. $I^2C$ DIO Board Connection Diagram -X10 - -X11*

## Analog and Digital I/O Board (ADIO)

Circuits on the ADIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

| ADIO I2C Wire Side View | | | | | |
|---|---|---|---|---|---|
| **Lead** | **Pin** | | | **Pin** | **Lead** |
| AI4 -10V | 2 | ∎ | ∎ | 1 | AI4 +10V |
| AI3 -10V | 4 | ∎ | ∎ | 3 | AI3 +10V |
| AI2 -10V | 6 | ∎ | ∎ | 5 | AI2 +10V |
| AI1 -10V | 8 | ∎ | ∎ | 7 | AI1 +10V |
| DI Common | 10 | ∎ | ∎ | 9 | DI4 Signal |
| DI Common | 12 | ∎ | ∎ | 11 | DI3 Signal |
| DI Common | 14 | ∎ | ∎ | 13 | DI2 Signal |
| DI Common | 16 | ∎ | ∎ | 15 | DI1 Signal |
| AO_GND | 18 | ∎ | ∎ | 17 | AO4 Current |
| AO_GND | 20 | ∎ | ∎ | 19 | AO3 Current |
| AO_GND | 22 | ∎ | ∎ | 21 | AO2 Current |
| AO_GND | 24 | ∎ | ∎ | 23 | AO1 Current |
| DO4 C | 26 | ∎ | ∎ | 25 | DO4 NC |
| DO3 NC | 28 | ∎ | ∎ | 27 | DO4 NO |
| DO3 NO | 30 | ∎ | ∎ | 29 | DO3 C |
| DO2 C | 32 | ∎ | ∎ | 31 | DO2 NC |
| DO1 NC | 34 | ∎ | ∎ | 33 | DO2 NO |
| DO1 NO | 36 | ∎ | ∎ | 35 | DO1 C |

**Analog Inputs:** -20 to 20mA into 50Ω or -10 to 10V, $R_{10}$=1MΩ, mutually isolated 10V

**Analog Outputs:** 0/4-20mA. Common negative pole, galvanically separated from ground, freely connectable to ground; working resistance 750Ω.

**Digital Inputs:** Optocoupler with internal 12-24VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24VDC, common negative pole.

**Digital Outputs:** Digital Outputs: Floating double-throw contacts, max. contact load rating 30V/1A

**Design:** Terminal strips for stranded or solid conductors with a maximum diameter of 1.0$mm^2$ or 18AWG.

*Figure 12. $I^2C$ ADIO Board Connection Diagram -X10 - -X11*

# Chapter 4

# Spare Parts and Replacement Procedures

## Introduction

### Overview

This chapter is intended for maintenance personnel.

The Chapter provides a list of replaceable parts and assemblies for the Network Access Unit (NAU). Subsequent information includes how to remove and replace the replacement part or assemblies.

### How to Place an Order

Parts can be ordered using the contact information at the beginning of this manual:

To ensure an immediate response to your request, you should provide the following:

- Purchase order number. If ordering by phone, a confirming P.O. should be sent.
- Address where the parts are to be shipped.
- Address where the invoice is to be sent.
- Part numbers as listed.
- Quantity needed of each part.
- Equipment Serial number or project number of the system (especially for warranty related orders).
- Preferred method of shipment.

# Available Parts

## Description

The available NAU assemblies and parts, with their applicable part number are shown below.

| Part Description | Ordering Number |
|---|---|
| Power Supply Module | A5E35679498001 |
| Fuse Kit | 2020151-001 |
| SYSCON Interface Board (SIB3 for SYSCON2.1) | A5E31994086001 |
| I/O Connector, SIB3 On-board I/O | 1700281-001 |
| Communication and Control Board, version 3 (CAC3 for SYSCON2.1) | A5E02599492004 |
| PCBA, NAU Backplane | 2015803-001 |
| Ethernet Switch Board (ESB) | A5E02368691001 |
| Ethernet Switch Board with Fiber (ESBF) | A5E02555919001 |
| $I^2C$ Digital I/O Board (DIO_I2C) | A5E02486268001 |
| $I^2C$ Analog I/O Board (AIO_I2C) | A5E02486267001 |
| $I^2C$ Analog and Digital I/O board (ADIO_I2C) | A5E02359491001 |
| Cable, 7 Connector, $I^2C$ | A5E32015524001 |
| NAU Color Touch Screen Assembly | A5E35757881001 |
| KIT, Touch Screen Cables, NAU | A5E35858157002 |
| Stylus, NAU | A5E35858154001 |
| Cable, SYSCON, Debug | 2017906-001 |
| Cable, SYSCON, Debug-Long | 2017906-002 |
| Termination, CAN Bus | 1700149-001 |
| Debug Port Extension Cable | 2020914-001 |

# Replacement Procedures

This section has replacement procedures unique to the NAU. Other procedures, such as replacing I/O boards, are the same as those given in the *Maxum edition II Process Gas Chromatograph Service Manual*, 2000596.

## Power Supply

This procedure requires a replacement power supply, part number A5E35679498001, and appropriate hand tools. Obtain any required permits to work on the equipment.

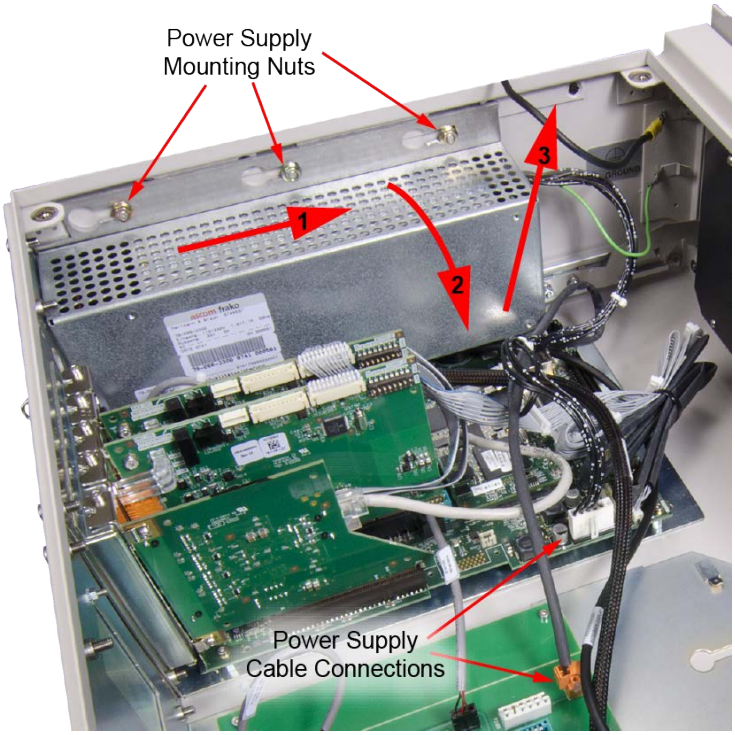



**Figure 13. Power Supply Removal**

1. Allow any applications to complete, and place in Hold.
2. Using GCP, save the existing database of the NAU to the hard drive of the Workstation.
   a. From the Network Portal, select the line entry for the device and then click the Backup button at the top of the view.
   b. The "Save backup file as..." dialog box will appear. Type or select a name for the backup file in the File Name field. If the user does not identify a file extension, then the default extension of .amd will be used.
   c. Click the Save button in the dialog box to begin the backup. A progress dialog box will appear, showing the saving of the database to flash memory and then the saving of the file to the computer. When the backup is complete the progress box displays "Successful"
   d. Click “OK” to close the progress box.

   The .amd database file is saved to the hard drive of the PC.

3. Power down.
4. Unplug external line-power cable.
5. Loosen the four retaining screws and open door.
6. For rack-mounted NAU:
   e. If the top of the NAU is easily accessible, ignore the following sub-steps:
      1. Disconnect I/O cables by unplugging the orange connectors.
      2. Remove rack screws, making sure that the NAU is supported.
      3. Pull NAU from rack space.

   f. Loosen the 4 retaining screws, and remove top NAU panel.

**Note:** While it may be possible to remove and replace the power supply in a rack-mounted NAU without removing the top, the task is easier with the top removed.

7. Disconnect the cables from the power supply to the SIB3 and the I/O expansion backplane.
8. Loosen the 3 power supply nuts, then slide PS forward, pivot inward, then lift it out of its mounting slot formed by a strip of metal welded to the side of the enclosure, and remove from the enclosure. (See numbered arrows in Figure 13)
9. Check line voltage setting on the replacement power supply. Make sure it is compatible with the local line voltage.
10. Insert the power-supply flange into the retaining slot on the side of the NAU enclosure.
11. Reinstall the 3 power-supply nuts.
12. Reconnect the power cables to the SIB3 and the I/O expansion backplane.
13. Reconnect any I/O cables that were removed earlier.
14. Power up the NAU and verify proper operation.

## Replacing a Color Touchscreen Assembly

Figure 14 shows the NAU door with the TIB cover removed to access the LCD mounting nuts. There are 5 nuts on mounting studs, shown in the red circles.

A kit, part number A5E35757881001 is required for this procedure, along with appropriate hand tools. Obtain any required permits for working on the equipment.

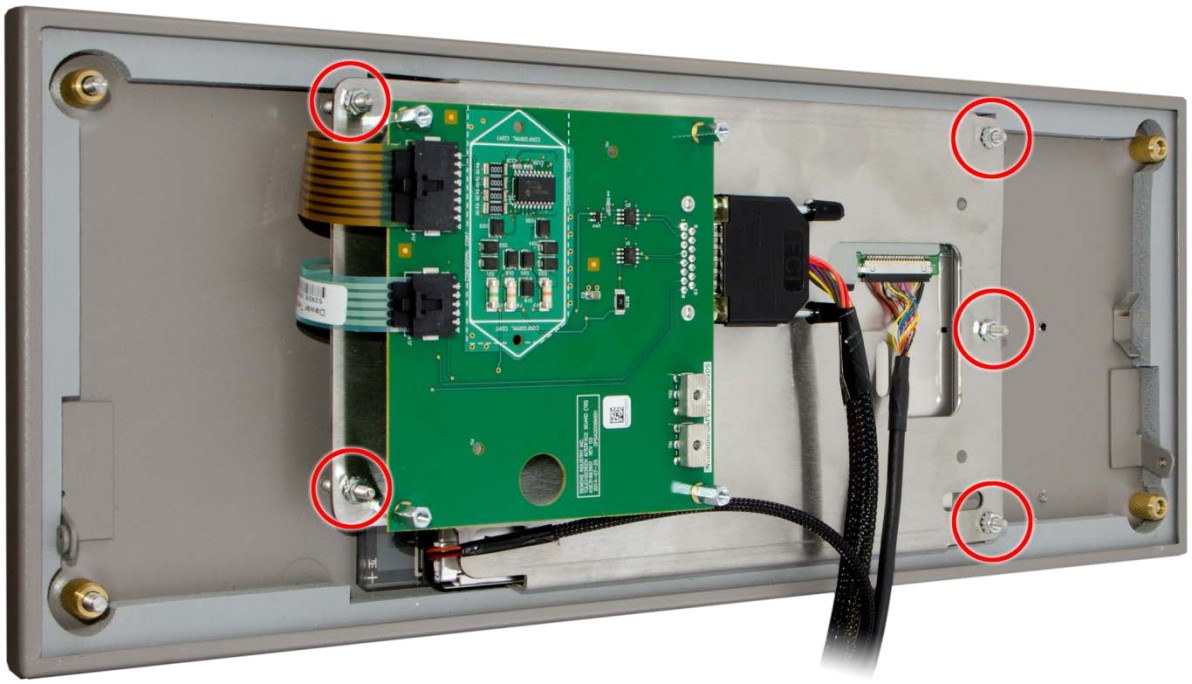


**Figure 14. NAU Door with TIB Cover Removed (Rack-Mount Door Shown)**

1. Allow any applications to complete, and place in Hold.
2. Using GCP, save the existing database of the NAU to the hard drive of the Workstation as described in the *Power Supply* replacement procedure.
3. Power down the NAU.
4. Loosen the four retaining screws and open door.
5. Cut the two wire ties securing the cable assemblies to the display assembly.
6. Loosen the retaining screws on the Touch Interface Cable connector and unplug the cables (see Figure 15).
7. Remove the TIB protective cover by removing the 4 screws. This allows access to two of the mounting studs for the LCD assembly.
8. Remove the two nuts on that side, along with the 3 nuts on the other side. (See Figure 14) This frees the LDC assembly, which can then be removed. Retain these parts for reassembly.
9. Remove the protective film from the LCD glass.
10. Install the new LCD assembly on the 5 studs, and install the 5 nuts. The nuts should be secure, but not tightened excessively.

11. Replace the TIB cover and the 4 screws holding it.
12. Connect the display cables and secure with wire ties as shown below.

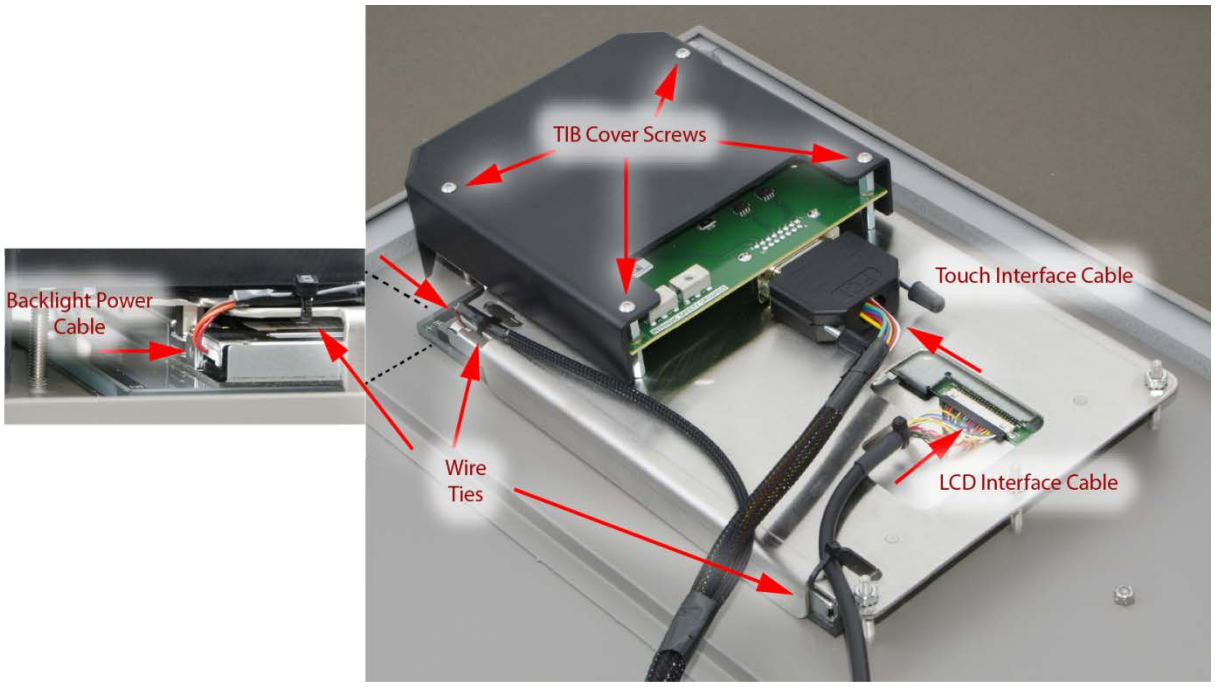



**Figure 15. Display Cable Connectors and Anchor Points (Wall-Mount Door Shown)**

13. Power up the NAU and verify proper operation.

## Replacing Display Cables

To replace the display cables, a replacement cable kit, part number A5E35858157002 is necessary.

1. Allow any applications to complete, and place in Hold.
2. Backup the database as described in the *Power Supply* replacement procedure.
3. Power down the NAU.
4. Unplug external line-power cable.
5. For rack mounted units, remove from the rack as described in the *Power Supply* replacement procedure.
6. Loosen the four retaining screws and open the NAU door.
7. Cut the wire ties and disconnect the display cables from the three points on the door-mounted display shown in Figure 15.
8. Remove the power supply as described in the *Power Supply* replacement procedure to access the display connectors on the SIB3 board. See Figure 16.

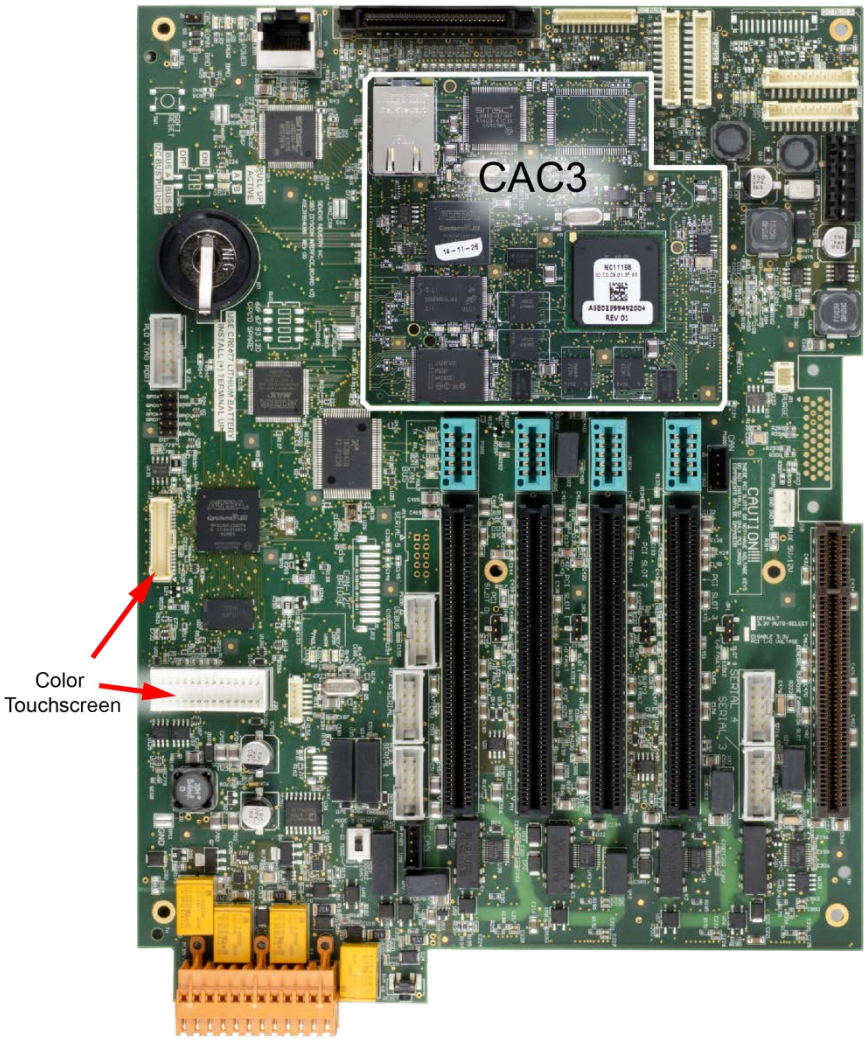
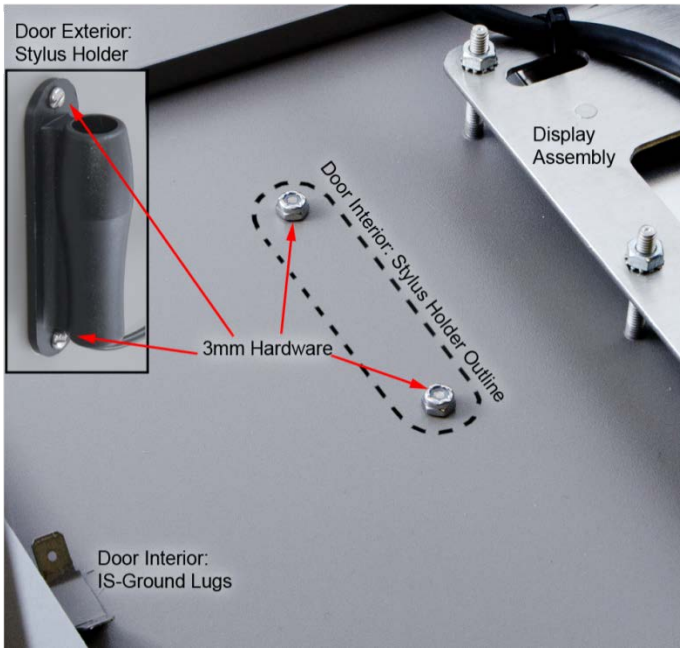



**Figure 16. SIB3 Display Connectors**

9. Remove the old display cables from J30 and J31 of the SYSCON2.1 assembly.
10. Connect and secure the new display cables to the door assembly as described in the *Replacing a Color Touchscreen Assembly* procedure.
11. Connect the new display cables to J30 and J31, shown in Figure 16.
12. Reinstall the power supply and reconnect the line-power cable.
13. Close door (on wall unit) or replace the top panel (rack mount) and reinstall in the rack.
14. Reconnect any I/O cables that were removed earlier.
15. Power up and verify proper operation.

## Replacing a Touch Screen Stylus

The touch-screen stylus holder on the door is held on by two 3mm screws, as shown below. The stylus and holder are molded together with a plastic tether as a single unit (part number A5E35858154001).



# Appendix 1

# Advance Communications System

## Overview

The Advance Communications System is used to connect a Maxum system to various communication networks including the Advance Data Hiway. This section provides an overview of the ACS and its components.

## Network Connectivity

The Advance Communications System (ACS) communication uses industry standard protocols and provides high-speed communication among all devices. The ACS can function alone or may be connected to a Distributed Control System (DCS) or plant-wide Local Area Network (LAN). As with other company systems, the network has complete backward compatibility with all Advance Data Hiway systems.

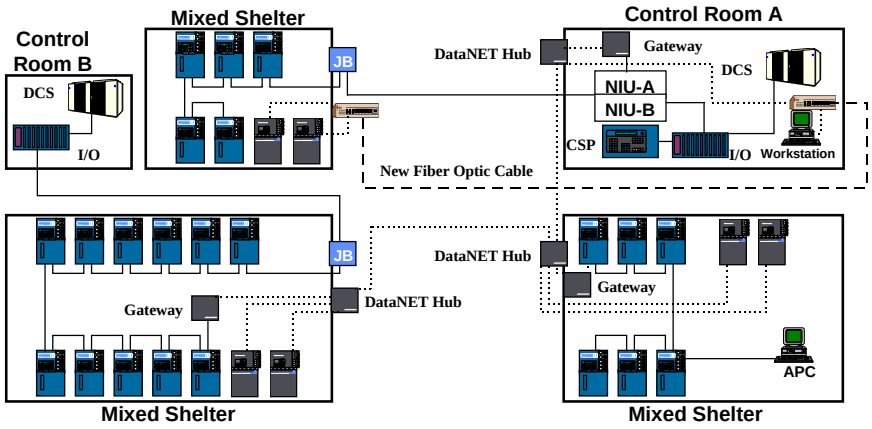



**Figure 17. Typical Network**

## Advance Data Hiway

A Maxum GC installed networking board enables the analyzer to tie directly onto any existing Advance Data Hiway. The Maxum GC has a virtual **Loop** and **Unit** number assigned so it can read and write to the Data Hiway and Modbus links.

The Data Hiway provides two way communications between any Data Hiway connected device. Each Data Hiway installed Advance and every Maxum Gas Chromatograph (GC), Service Panel, APC Workstation and I/O device has its own unique address with an assigned specific **UNIT** number and **LOOP** number.

The Data Hiway provides input and output communications from any location on the Data Hiway as well as multiple locations. It provides a direct serial Modbus link to the plant DCS System.

With a Data Hiway network, communication occurs over a pair of twisted shielded pair cables which allows up to 31 devices to be connected into

one network loop. This allowed for redundant communications. One cable is for channel A and one for channel B. Each loop can be up to 5,000 feet. See Figure 18.

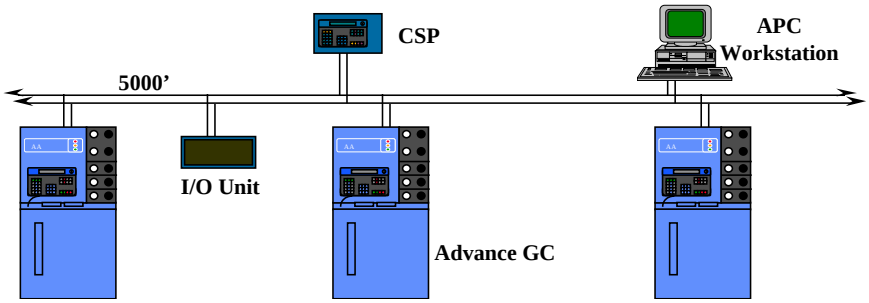



**Figure 18. Typical Example of Advance Data Hiway**

**More Information** See Appendix 2. Connecting a Maxum to Advance Data Hiway

## Ethernet Network

The Maxum GC has an Ethernet connection installed on the Electronic Enclosure rear SYSCON Control Assembly connector bracket. This connection is accessible when the Maxum GC Electronic Enclosure access door is opened. The Maxum GC is compatible with any standard Ethernet system and is fully compatible with Ethernet Hubs, Routers and cabling schemes. These include fiber optics and wireless techniques.

Each installed Maxum GC can be assigned an IP address without restrictions of an artificial numbering structure.

## Gateway Unit

The Advance Network Gateway Unit (ANG) provides the connection point between existing Advance Data Hiway and the Maxum GC Ethernet networks. The unit is a translator for converting signal and communication protocols. This conversion allows Maxum GCs and Advance GCs to communicate with each other in addition to using each other's Distributed Control System (DCS) I/O links.

Advance Optichrom Service Panels and older APC workstations can display GC information over the Gateway link. They are, however, limited to only accessing and changing basic operational status. This data includes alarms, run/hold/calibrate, view, analysis results etc.

## NAU Functions

The Network Access Unit (NAU) has the capability for controlling Advance and Maxum GCs from its HMI and to provide I/O board expansion slots. The unit serves as the controller to receive messages on the Ethernet and perform the following functions.

- Convert information to the appropriate messages for the local I/O boards and
- Convey information to the installed I/O boards over the $I^2C$ Bus.

## Existing Configuration

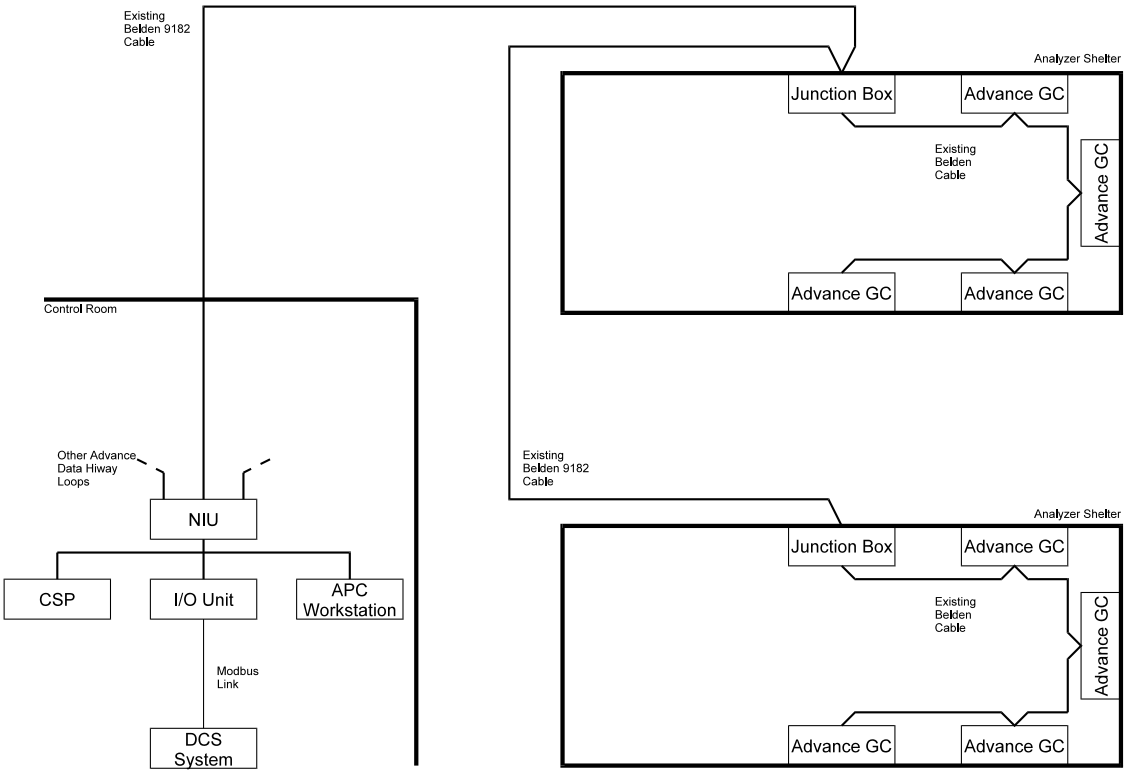
**Advance GCs in an Analyzer Shelter Communicating to Control Room DCS System.**

This is a basic Analyzer Shelter Advance GC installation. All Advance GCs are daisy-chained together using standard existing Advance Data Hiway Belden cable and Junction Box. Refer to Figure 19.

The terminating cable from the last Advance GC is terminated in the Junction Box. If additional Analyzer Shelters are installed, they are parallel connected to the last Analyzer Shelter Junction Box using standard Belden cable.

Analyzer Shelters are connected to the Control Room using standard existing Belden cable. The Control Room installed NIU connects the Advance GC's information to the I/O Unit and to the DCS System via the Modbus Link.

This configuration **does not** use Ethernet Hubs.




***Advance GCs in Analyzer Shelter Communicating to DCS System in Control Room***

***Figure 19.*** **Existing Installation**

# Appendix 2

# Connecting a Maxum to Advance Data Hiway

## Overview

The Advance Communications System (ACS) is used to connect the Maxum system to various communication networks including the Advance Data Hiway. This section provides users with information on various ways to connect a Maxum to their existing Data Hiway installation. The Maxum Communication System provides the user with "*backward*" compatibility.

## Configuration Options

When evaluating each configuration, consider the following:

- Size of present system.
- Preference for keeping present wiring configuration and
- Future expansion requirements for interconnecting the entire
- Gas Chromatograph system into plant LAN and DCS Systems

| Option | Function |
|---|---|
| 1 | Connect New Maxum GCs Directly to Existing ADH Using Installed ADH Card. |
| 2 | Two Separate Parallel Networks Merged in the Control Room via Installed Gateway. |

### Option 1

**Connect New Maxum GCs Directly to Existing ADH Using Installed ADH Card**

***Advantages***

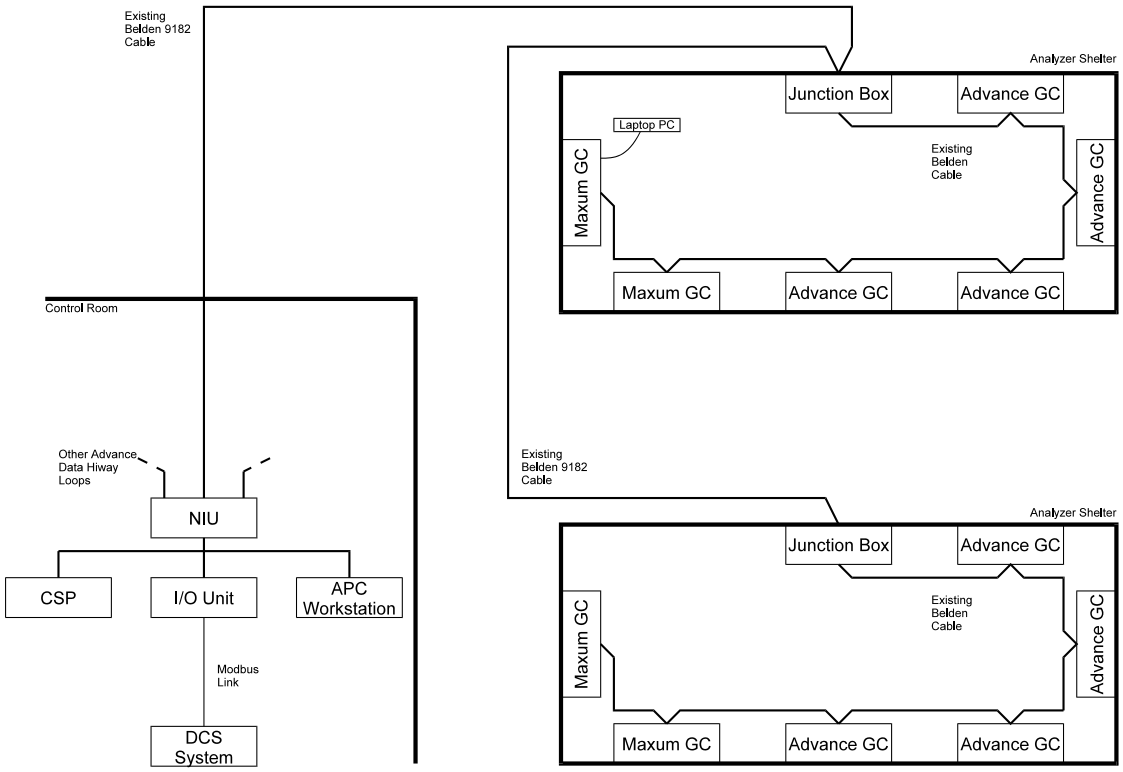
This is the simplest means for connecting a Maxum to the Advance Data Hiway (ADH). To use this option, the Maxum must have an ADH card installed in the SYSCON motherboard. See Figure 20.

Maxum Analyzers are wired exactly like Advance and can transmit analysis results over the existing link to the facilities DCS. Other devices on the network, such as CSPs and APCs are able to observe installed Maxum analyzers. This enables the user to view analysis results, start and stop analyzer functions and initiate calibration. The user can view and acknowledge Maxum alarms over the Data Hiway.

***Limitations***

The Maxum uses a different software format for program application development, chromatogram processing and viewing. This inhibits information from being transmitted over the Data Hiway. To make any application changes, the user must connect a laptop PC with Maxum workstation software loaded.

To make backup copies of the Maxum software, the laptop PC must be connected. Chromatograms from remote locations cannot be seen.




***Connect New Maxums Directly to Existing ADH Using Installed ADH Card***

**Figure 20. Option 1 Configuration**

**Option 2**

**Two Separate Parallel Networks Merged in the Control Room via Installed Gateway**

This is for adding a new Maxum to existing installed Advance GCs. With this option, the existing Data Hiway is retained. A parallel Maxum network based on an Ethernet network link is routed back to the Control Room. See Figure 21.

In the Control Room, the Ethernet network is connected to existing Data Hiway via the Gateway. This provides the Maxum with full access to devices installed on the Data Hiway. This can be an existing link to the DCS that is able to communicate with the installed Maxum the same way it talks to installed Advance GCs.

To provide a Maxum with communication access, an Ethernet network is established by adding an Ethernet Hub in the analyzer shelter. Ethernet wiring is used to interface the installed Maxum to the Ethernet Hub.

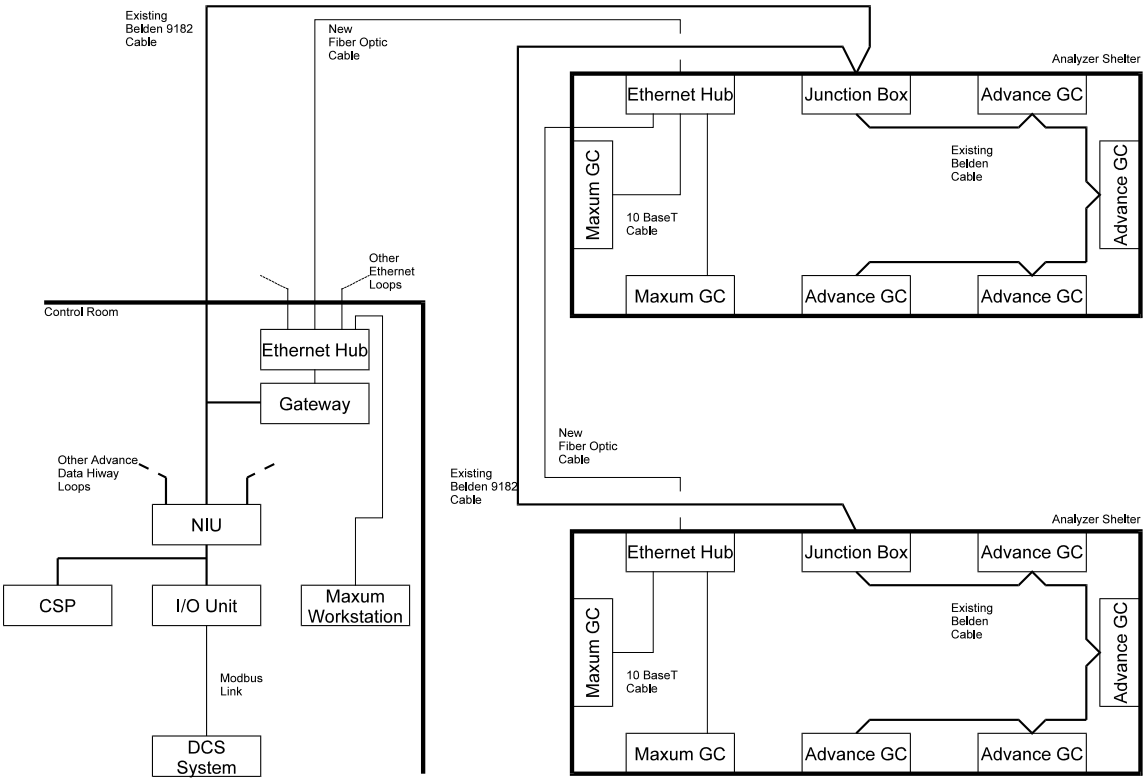
Fiber optic wiring can be used to connect the analyzer shelter installed Ethernet Hub to the Control Room. This wiring can be run long distances and is immune to generated electronic noise.

Fiber optic cable, from the analyzer shelter, must be terminated in a control room installed Ethernet Hub. This Ethernet Hub connects all Ethernet loops together and provides access to the installed Gateway. The Gateway allows a Maxum to communicate with the DCS over the existing Modbus link.

To the DCS, a Maxum appears identical to the Advance GCs to which are already communicating.

The APC Workstation can be upgraded to the Maxum workstation. The Maxum workstation provides real-time chromatogram displays of all installed Maxum GCs as well as EZChrom Methods Development software.

Older APC functions are integrated into the Maxum workstation and all previous APC functions are retained. This allows Maxum workstation to communicate with older Advance GCs via the Gateway. In addition, it provides PSP Emulation, Chromatogram displays and Table Editing etc.




***Two Separate Parallel Networks Merged in the Control Room via Installed Gateway***

**Figure 21. Option 2 Configuration**

# Appendix 3

# CEMS Option

## Overview

### Description

The NAU Continuous Emission Monitoring System (CEMS) software option provides sample system control and general data acquisition for up to four Siemens continuous analyzers or most other analyzers or devices. When connected via our Advance Communications System (ACS) the NAU can be remotely accessed from the Maxum workstation.

### I/O Summary

2 combination I/O boards
4 digital I/O boards

| | |
|---|---|
| DO channels | 20 |
| DI channels | 12 |
| | 8 spares |
| AO channels | 4 spares |
| AI channels | 4 |

Built-in Standard

| | |
|---|---|
| DO channels | 4 spares |
| CI channels | 4 spares |
| AO channels | 2 spares |

RS-232 serial channel 1 (up to 4 configurable with SYSCON2 or later)
RS-485 serial channel 1 (up to 4 configurable with SYSCON2 or later)

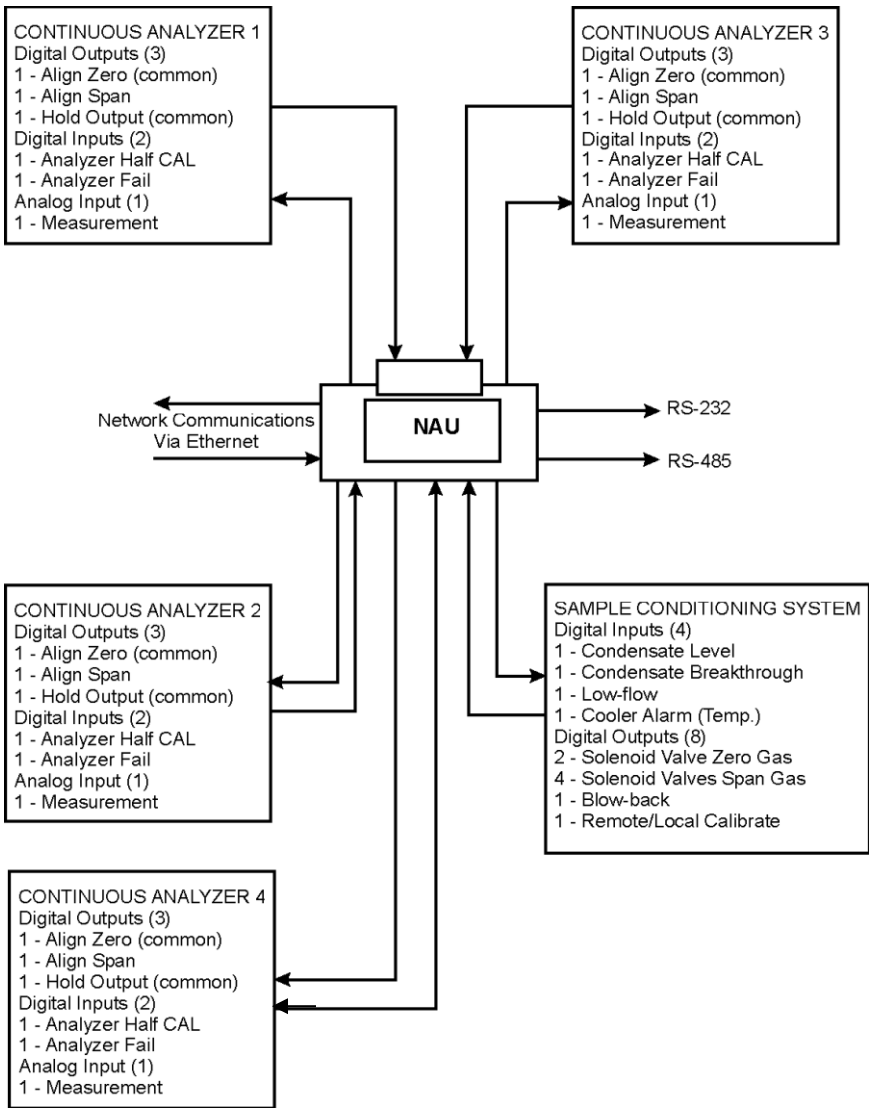



**Figure 22. NAU – Three- Analyzer CEMS Application**

**Monitoring and Control**

The digital I/Os can be used for monitoring and control of such parameters as condensate level, cooler alarm, remote, and local calibration; see Figure 22 and Figure 23.

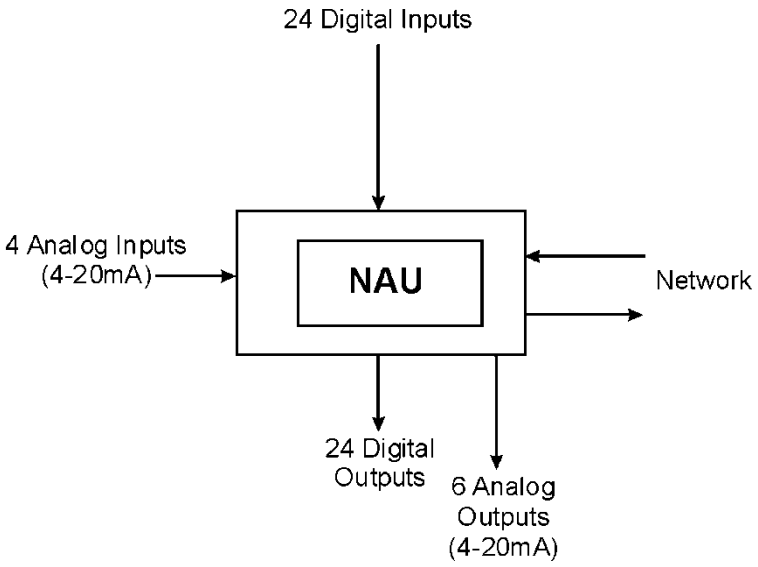



**Figure 23. Input/Output Capability**

**CEM Data Logging**

It scans each of the monitored component concentrations 6 times per minute. The NAU averages the 6 values to yield a 1-minute average for each component. The NAU stores 1-minute averages and computes 1-hour averages for each component.

**Storing Data**

The NAU can store up to 3 days of 1-minute data averages. If the data-logging computer fails, the NAU can upload up to 3 days of 1 minute averages after the communications is restored. When uploading, the NAU can transfer all data within 60 seconds via Ethernet or about 2.5 hours via RS-232 or RS-485 at 19.2 Baud. This balances the load on the highway by sending 8 hours of stored data every 15 minutes.

# NAU CEMS Programming

## Introduction

Each NAU unit is programmed with a standard database unless a custom application was purchased. This database provides pre-defined tables and programs that handle the requirements of a basic single process Continuous Emission Monitoring (CEM) application. Two (2) zero gas stream and four (4) span gas streams are designed into the NAUs standard Table Set. As with our Maxum Chromatographs, the standard application can be configured to meet individual customer requirements; see your custom documentation that was shipped with the equipment if a custom application was purchased.

## Standard Applications

- Blow back
- Calibration Control
- Data Averaging
- Data Collection
- Data Storage
- Data Transmission
- Sample Control

## Learning Hint

The NAU performs functions in real-time. These functions are called events; see Application Documentation.

## Blow Back

The software provides sample probe blow back control and is designed for maximum flexibility. Three factor entries allow you to easily modify the number of pulses and the width of each pulse. The blowback is typically scheduled once per day, but can be initiated on demand through a local or remote user provided interface.

## Calibration Control

Software provides necessary timing and logic to initiate an external calibration of a Continuous Analyzer. This event is typically scheduled once per day, but can be initiated on demand through a local or remote user provided interface. The amount of time allowed to purge the sample line when switching between processes and calibrate gases is easily customized by modifying the appropriate factor.

The Continuous Analyzer is notified via a relay output when to self-calibrate for zero or span. Percent drift is calculated and stored in the NAU along with the calibration values. A calibration alarm is initiated if the drift is outside of acceptable limits.

## Data Averaging

Data averaging occurs at 1 minute, 15 minute, hourly and daily intervals. The 1-minute averages are automatically status, time, and date stamped as they are written to the data table. A circular queue is used for storage of all the 1-minute averages taken in the last 3 days. The status is stored in the database prior to writing a value in the data table.

| Averages | Description |
|---|---|
| 1-Minute | Six measurements are taken each minute for the analog inputs and are averaged together for a 1-minute average. |
| 15-Minute | 15-minute averages are generated and stored for verification of the hourly averages in the daily log. |
| Hourly | Hourly averages are generated and stored for use in the daily log. |
| Daily | Daily averages are generated and stored for use in the monthly log. |

## Data Collection

Both Analog and digital inputs are scanned every 10 seconds.

## Analog Values

Analog inputs are scanned every 10 seconds. Values are added to each scan and the counters are incremented which are used by the averaging events. Continuous Analyzer status, at the time of the scan, is checked and the highest priority status is stored.

## Digital Status

Event 4 scans the digital inputs. The digital input information is used for status and alarm generating purposes. The information is also evaluated based on the priority list shown below along with the Continuous Analyzer status; the highest priority status is stored for stamping 1-minute averages.

| Status Number | Description |
|---|---|
| 250 | Calibrate in progress |
| 249 | Blow Back in Progress |
| 248 | Continues Analyzer Failure |
| 247 | Condensate Alarm |
| 246 | Low Flow Alarm |
| 245 | Cooler Temperature Alarm |
| 244 | Sample Line/Probe Temperature Alarm |
| 120 | Half-Cal Alarm |

Highest priority = 255
Status = 0 means Continuous Analyzer running normally with no alarm
Status above 127 indicates a Fault problem.

## Data Storage

The data averages are stored in SYSCON memory in the data table as shown below.

| Data | Quantity Stored |
|---|---|
| 1 Minute Averages | Last 3 days |
| 15 Minute Averages | Current days information since midnight |
| Hourly Averages | Current days information since midnight |
| Daily Averages | Current months information since start of month |

## Data Transmissions

The workstation provides for three forms of Data Transmission via a printer, Maxum Data Logger or Host Computer or via Ethernet.

## Printer

Three printout Logs are available. All can be scheduled to print automatically or on request.

| | |
|---|---|
| Hourly Log | Prints a log of the 1-minute averages taken during the current hour. |
| Daily | Prints a log of the 1- hour averages taken during the current day. The 15 minutes averages are also printed in order to validate the hourly averages. |
| Monthly | Prints a log of the daily averages taken during the current month. |

## Sample Control

Sample Control is provided by stream-switching between processes, zero-calibration gas and span calibration gas as well as blow-back control.

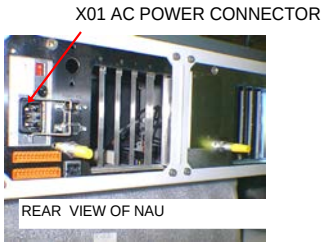
# Appendix 4

# Legacy NAU Components

## SYSCON Connections

### Description

This section shows the connections to the NAU System Controller (SYSCON). The SYSCON connections are visible at the rear of the NAU. If you are installing a wall-mounted unit you must first remove the front or side covers to see the SYSCON connections.




The connections to the SYSCON are shown below. Applicable I/O connection diagrams are shown on the following pages.

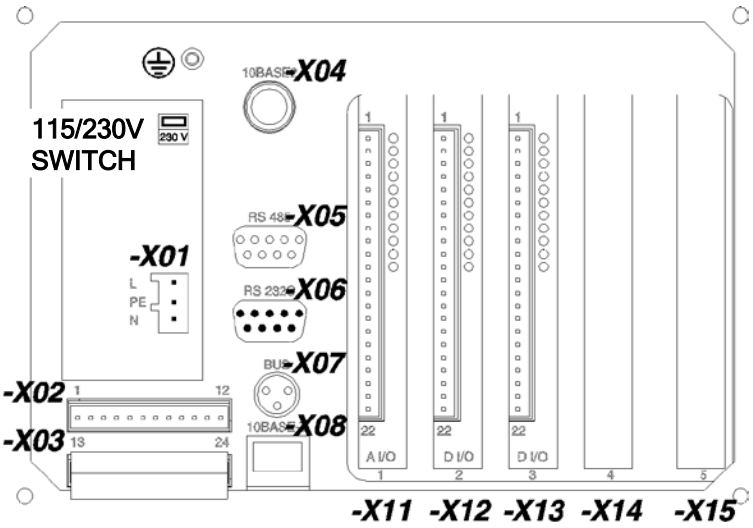
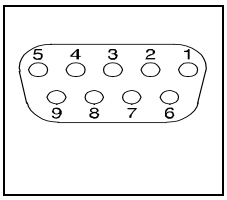



**Figure 24. Electronic Module Connections**

***-X01*** 115 VAC or 230 VAC power supply
***-X02*** Digital outputs (system controller)
***-X03*** Analog outputs and digital inputs (system controller)
***-X04*** Ethernet 10BASE2
***-X05*** RS-485 port for MODBUS communications
***-X06*** RS-232C port connection for serial devices. For example a printer
***-X07*** System bus for add-on CAN Extension Unit
***-X08*** Ethernet 10BASE-T
***-X11*** ***-X15*** Analog and digital I/O boards
**115/230 Switch 115**-230 AC voltage selector switch.

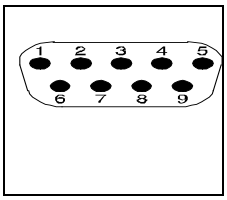
## RS-485 Port -X05




2 RTxD–
3 RTxD+
5 GND

Design: 9-pin Sub D female connector

## RS-232C Port -X06




2 RxD
3 TxD
5 GND

Design: 9-pin Sub D male connector

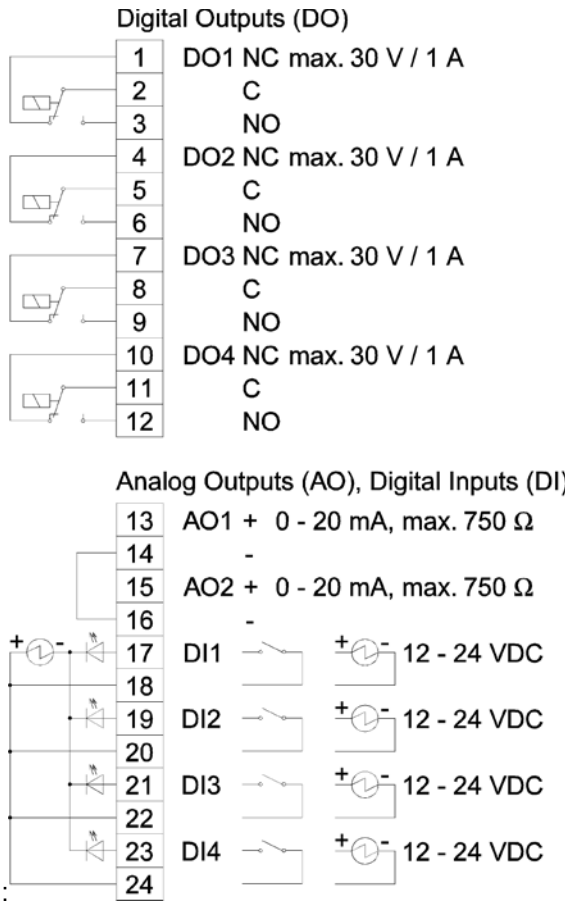
## RJ45 Ethernet Port X-08

1 T+
2 T–
3 R+
6 R–

Design: 8-pin RJ45 Jack
Using Pairs 2 & 3

## SYSCON Board I/O Connection

The actual pin layouts with input and output signals in a delivered NAU are shown in the applicable custom documentation package.


Digital Outputs (DO)
1 DO1 NC max. 30 V / 1 A
2 C
3 NO
4 DO2 NC max. 30 V / 1 A
5 C
6 NO
7 DO3 NC max. 30 V / 1 A
8 C
9 NO
10 DO4 NC max. 30 V / 1 A
11 C
12 NO
Analog Outputs (AO), Digital Inputs (DI)
13 AO1 + 0 - 20 mA, max. 750 Ω
14 -
15 AO2 + 0 - 20 mA, max. 750 Ω
16 -
17 DI1 12 - 24 VDC
18
19 DI2 12 - 24 VDC
20
21 DI3 12 - 24 VDC
22
23 DI4 12 - 24 VDC
24

| | |
|---|---|
| DO1-DO4 | Digital Outputs:<br>Floating double-throw contacts, max. contact load rating 30 V/1A. DO1 is not administrable and is dedicated to “Fault” (active when the SYSCON has an active alarm). |
| AO1-AO2 | Analog Outputs:<br>0/4-20mA. Common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50 B, max. working resistance 75 ohms. |
| DI1-DI4 | Digital Inputs:<br>Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole |
| Design | Two 12-pin terminal strips for stranded or solid conductors with a maximum section of 1.5 $mm^2$ or 16AWG. |

**Figure 25. System Controller Connection Diagram -X02,XO3**

## CAN I/O Boards

**Available CAN I/O/ Boards:**

1. Analog output board (AO-8) that provides 8 channels of analog output;
4. Digital board (DIO-4) that provides 4 digital output and 4 digital input signals;
5. Combination board (AO-4), that provides 2, channels each of digital input, digital output, and analog input and analog output.

### Removing or Replacing CAN I/O Boards

This section should only be used by maintenance personnel when adding, removing or replacing a CAN I/O module. All factory installed CAN I/O Modules have been pre-configured at the factory.

### IMPORTANT

This procedure configures the analyzer software to recognize the addition, deletion, or replacement of a CAN Module within an analyzer system. It does not assign it to an application. All CAN I/Os must be configured for use within an application from the Advance System Manager software; see Advance System Manager, online Application I/O help file.

### Serial Number

A serial number label affixed to each CAN I/O Board. This 14-digit serial number is used in the following procedure when adding or replacing a module. The serial number contains the following information.

<u>002</u> <u>00000012301</u>

Module Serial Number
Module Type
002 Analog I/O Board
003 Digital I/O Board
007 AO8 Board

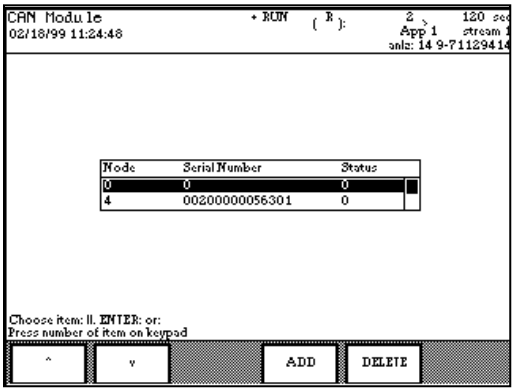
### Node Number

A node number is assigned to each CAN I/O Board when it is installed in a Maxum, CAN Extension Unit, or Network Access Unit. Because of the assigned node number, a CAN Module can be placed in any board slot within these units. Node numbers cannot be duplicated within any analyzer system. The node number can be any 1 to 3-digit number but cannot be or start with a ‘0’.

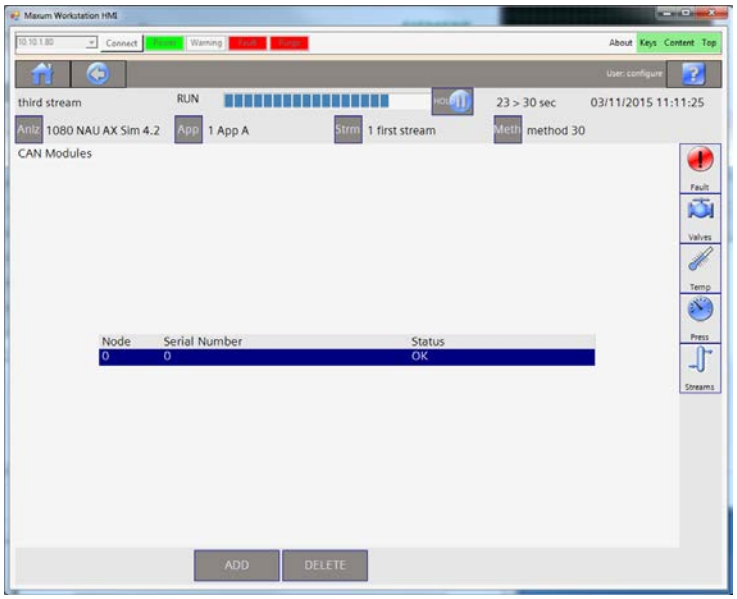
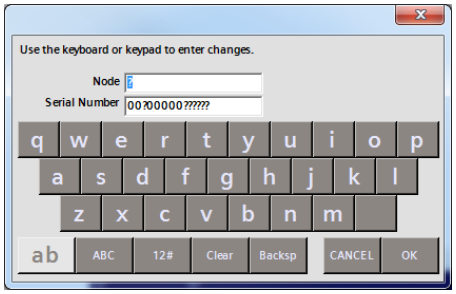
### SYSCON Can Module Slots

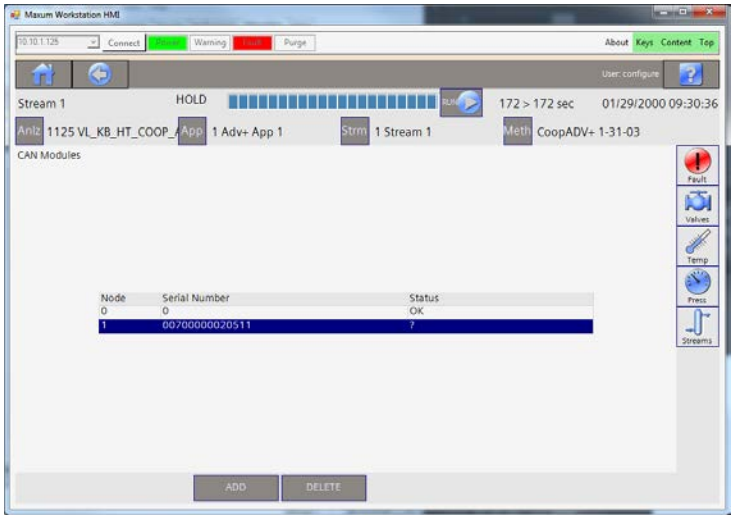
There are only four slots available on the SYSCON module for CAN cards. The fifth slot does not have a CAN card connector.

## Instructions for Use with HMI-Equipped NAUs

| Step | Description |
|---|---|
| 1. | Ensure that the HMI is connected to the analyzer system to which the CAN Module was added or removed. |
| 2. | Go to the **CAN Module** screen.<br>**Configure Menu → SYSTEM I/O→ CAN MODULES**<br>  |
| 3. | Make a selection from the following Table.<br><br>To……. / THEN……..<br>ADD a CAN Module / Go To Step 4.<br>Delete a CAN Module / Use ▲ ▼ to select the Module and press DELETE. |
| 4. | Release 4.3 or below: Press ADD soft key. The CAN entry dialogue screen will appear.<br><br>Release 5.0 and above: Select the line corresponding to the desired node number and Press the ADD soft key. The CAN entry dialog line will appear at the bottom of the screen. |
| 5. | Enter the 14-digit Module serial number of the added CAN Module. |
| 6. | Release 4.3 or below: Press **Next Field** soft key to highlight **Node** field and enter a node number for the module.<br><br>Check Your Node Number<br>You can return to the CAN Module screen and verify that the number you selected is not already in use; simply press BACK soft key. |
| 7. | Press **DONE** soft key (Rel 4.3 or below) or the ACCEPT CHANGE soft key (Rel 5.0 or higher).<br><br>The CAN Module screen will appear with the added CAN Module. The added CAN I/Os must now be added to an application using the Advance System Manager software; see Advance System Manager, online Application I/O help file. |

## Instructions for Use with Color Touchscreen-Equipped NAUs

| Step | Description |
|---|---|
| | Ensure that the Color Touchscreen is connected to the analyzer system to which the CAN Module was added or removed. |
| | From the Home screen, navigate to this location:<br>**Configure → System I/O→ CAN Modules**<br>  |
| | Enter the Node number and Serial Number, then click OK.<br>  |

| Step | Description |
|---|---|
| 8. | The CAN Module screen will appear with the added CAN Module.<br>  |
| 9. | The added CAN I/Os must now be added to an application using the GCP software. |

## CAN I/O Board Information

**Power Supply/CAN (4-Pin Orange Edge Connector)**

The following is signal and voltage information for the Power Supply/ CAN.

| Connector Pin | Signal |
|---|---|
| 1 | CAN High |
| 2 | CAN Low |
| 3 | Ground |
| 4 | +24VDC |

**Edge Connector**

The following is signal and voltage information pertaining to the Edge Connector.

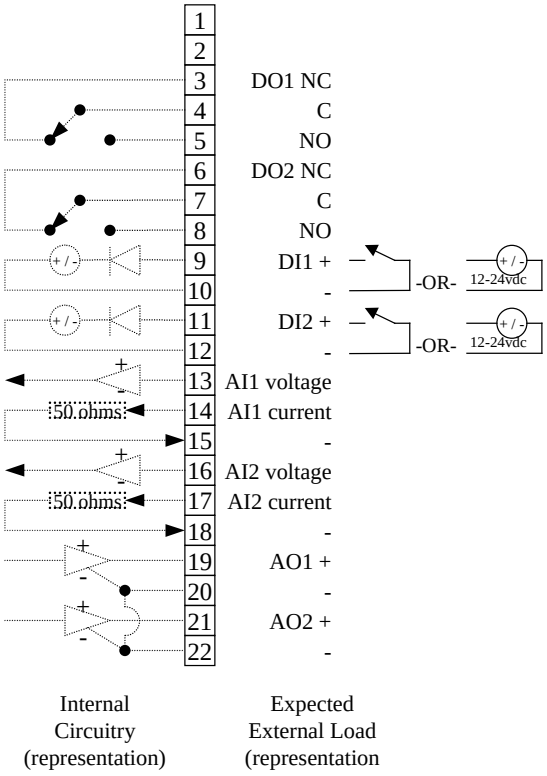
| Connector Pin | Signal |
|---|---|
| 1&2 | CAN High |
| 3 | CAN Low |
| 4 | Reserved |
| 5&6 | Common Ground |
| 7&8 | +24VDC |
| 9 | Reserved |
| 10 | Reserved |

## CAN Bus Combination Analog/Digital I/O Board

Analog/Digital I/O Board provides 8-LED troubleshooting status lights. The status lights provide maintenance personnel with the information on what functions occur when a status light is illuminated. Status lights illuminate red, green or orange.

Each board mounted relay requires 24VDC @ 1A to energize. All relays are isolated against NAU chassis and each other.

Optocoupler inputs activate on current flow and become active when current is more than 4mA. Inputs contain internal voltage supply so that passive switches can easily be connected. Although Optocoupler inputs have a common ground, they are isolated against NAU chassis.




| | |
|---|---|
| DO1-DO2 | Digital Outputs:<br>Floating double-throw contacts, max. contact load rating 30V/1A |
| DI1-DI2 | Digital Inputs:<br>Optocoupler with internal 12-24VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24VDC, common negative pole |
| AI1-AI2 | Analog Inputs:<br>-20 to 20mA into 50Ω, -10 to 10V, $R_{10}$= 1MΩ, mutually isolated to 10V |
| AO1-AO2 | Analog Outputs:<br>0/4-20mA. Common negative pole, galvanically separated from ground, freely connectable to ground; working resistance 750Ω. |
| Design | One 22-pin terminal block for stranded or solid conductors |

with a maximum section of 1.5mm$^2$ or 16AWG.

**Figure 26. Combination Analog/Digital I/O Board Connection Diagram -X11-X15**
**The ON color state of the LEDs indicate status of function.**

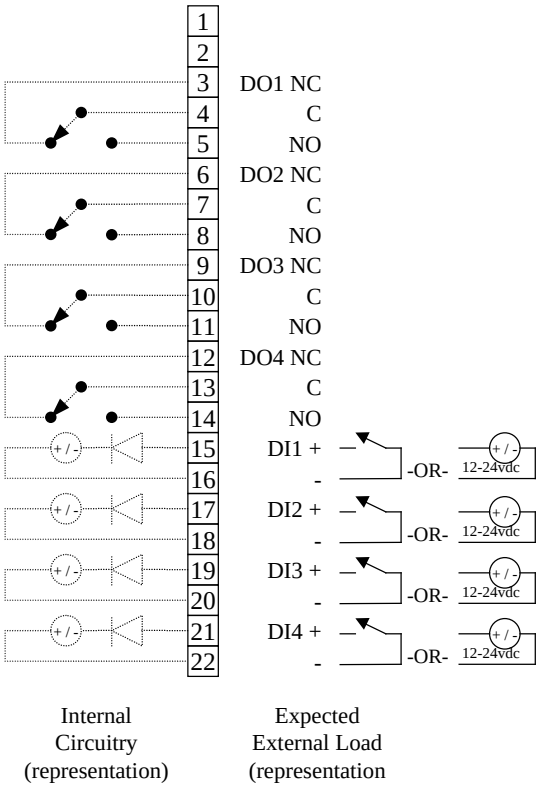
| LED Board Position | Light Color | Signal | LED Function |
|---|---|---|---|
| 1 | Orange | Maintenance Request | S.U. |
| 2 | Red | Failure | S.U. |
| 3 | Green | Power | Power Supply to Microprocessor is correct |
| 4 | None | ---------- | Reserved |
| 5 | Orange | Relay Output #1 | Relay is Active |
| 6 | Orange | Relay Output #2 | Relay is Active |
| 7 | Orange | Optocoupler Input #1 | Input is Active |
| 8 | Orange | Optocoupler Input #2 | Input is Active |

Field Termination connector pin orientation is on the left side when viewing the pins.

**Combination Analog/Digital Board Terminations**

| Connector Pin | Signal | Output |
|---|---|---|
| 1 | ---------- | Not Used |
| 2 | ---------- | Not Used |
| 3 | Output Relay #1 | Normally Closed |
| 4 | Output Relay #1 | Ground |
| 5 | Output Relay #1 | Normally Open |
| 6 | Output Relay #2 | Normally Closed |
| 7 | Output Relay #2 | Ground |
| 8 | Output Relay #2 | Normally Open |
| 9 | Input, Optocoupler # 1 DI | + Signal |
| 10 | Input, Optocoupler # 1 and 2 | Common Ground |
| 11 | Input Optocoupler # 2 | + Signal |
| 12 | Input, Optocoupler #1 and #2 | Common Ground |
| 13 | Input, Analog #1 | + Voltage |
| 14 | Input, Analog #1 | Current |
| 15 | Input, Analog #1 | Ground |
| 16 | Input, Analog #2 | +Voltage |
| 17 | Input, Analog #2 | Current |
| 18 | Input, Analog #2 | Ground |
| 19 | Output, Analog #1 | Current, +Signal |
| 20 | Output, Analog #1 and #2 | Common Ground |
| 21 | Output, Analog #2 | Current, +Signal |
| 22 | Output, Analog #1 and #2 | Common Ground |

## CAN Bus Digital I/O Board (DIO)




| | |
|---|---|
| DO1-DO4 | Digital Outputs:<br>Floating double-throw contacts, max. contact load rating 30V/1A |
| DI1-DI4 | Digital Inputs:<br>Optocoupler with internal 12-24VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24VDC, common negative pole. |
| Design | One 22-pin terminal strips for stranded or solid conductors with a maximum section of 1.5mm$^2$ or 16AWG. |

**Figure 27. Digital I/O Board Connection Diagram -X11- X15**

| LED Board Position | Light Color | Signal | LED Function |
|---|---|---|---|
| 1 | Orange | ---------- | Maintenance Request |
| 2 | Red | ---------- | Failure |
| 3 | Green | Power | Power Supply to Microprocessor is Correct |
| 4 | -------- | ---------- | No Function |
| 5 | Orange | Relay Output #1 | Relay is Active |
| 6 | Orange | Relay Output #1 | Relay is Active |
| 7 | Orange | Relay Output #1 | Relay is Active |
| 8 | Orange | Relay Output #1 | Relay is Active |
| 9 | ---------- | ---------- | No Function |
| 10 | Orange | Optocoupler Input #1 | Input is Active |
| 11 | Orange | Optocoupler Input #2 | Input is Active |
| 12 | Orange | Optocoupler Input #3 | Input is Active |
| 13 | Orange | Optocoupler Input #4 | Input is Active |

**Figure 28. Table 3-3: DIO Status LEDs**

The ON color state of the LEDs indicate status of function.

Field Termination connector pin orientation is on the left side when viewing the pins. Pin 1 is at top.

**Digital I/O Board Terminations**

| Connector Pin | Signal | Output |
|---|---|---|
| 1 | Reserved | ---------- |
| 2 | Reserved | ---------- |
| 3 | Output Relay #1 | Normally Closed |
| 4 | Output Relay #1 | Common |
| 5 | Output Relay #1 | Normally Open |
| 6 | Output Relay #2 | Normally Closed |
| 7 | Output Relay, #2 | Common |
| 8 | Output Relay #2 | Normally Open |
| 9 | Output Relay #3 | Normally Closed |
| 10 | Output Relay #3 | Common |
| 11 | Output Relay #3 | Normally Closed |
| 12 | Output Relay #4 | Normally Open |
| 13 | Output Relay #4 | Common |
| 14 | Output Relay #4 | Normally Closed |
| 15 | Input, Optocoupler #1 | + Signal |
| 16 | Input, Optocoupler | Common |
| 17 | Input, Optocoupler #2 | + Signal |
| 18 | Input, Optocoupler | Common |
| 19 | Input, Optocoupler #3 | + Signal |
| 20 | Input, Optocoupler | Common |
| 21 | Input, Optocoupler #4 | + Signal |
| 22 | Input, Optocoupler | Common |

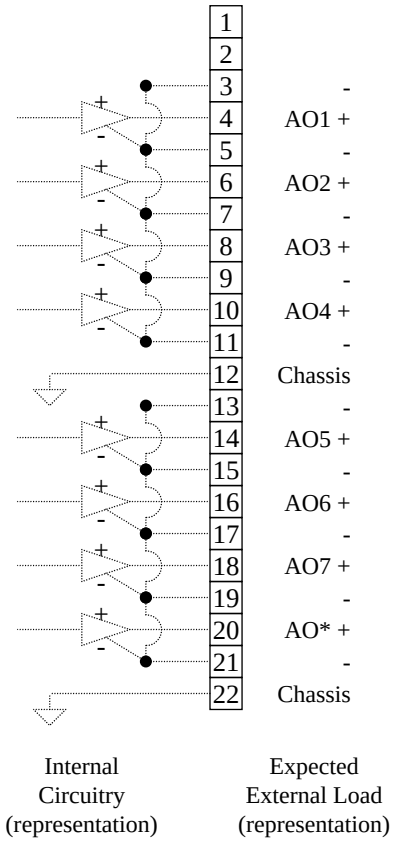
## CAN Analog Output Board (AO8)

AO8 Board provides 3-LED status lights that illuminate orange, red or green.

### *A/O Functions*

**Clear:** Analog outputs are reset to 0mA during Gas Chromatograph start-up. This also occurs for bus disruption.

**Error Detect:** Each output cable carries low (μA level) of minimum current. Each pair of outputs share a common error signal such as AO1 with AO2, AO3 with AO4.




| | |
|---|---|
| A01-A08 | Analog Outputs:<br>0/4-20mA. Common negative pole, galvanically separated from ground, freely connectable to ground; working resistance 750Ω. |
| Design | One 22-pin terminal strips for stranded or solid conductors with a maximum section of 1.5mm$^2$ or 16AWG. |

**Figure 29. 8 Analog Output Board Connection Diagram X11-X15**

**AO8 Status LEDs**
The ON color states of the LEDs indicate status.

| LED Board Position | Light Color | Signal | LED Function |
|---|---|---|---|
| 1 | Orange | ---------- | Maintenance Request |
| 2 | Red | ---------- | Failure |
| 3 | Green | Power | Power Supply to Microprocessor is Correct |

Field Termination connector pin orientation is on the left side when viewing the pins. Pin 1 is at top.

**AO8 Board Terminations**

| Connector Pin | Signal | Output |
|---|---|---|
| 1 | Not Used | ---------- |
| 2 | Not Used | ---------- |
| 3 | Output, Analog #1 to #4 | Common |
| 4 | Output, Analog #1 | Low Current, + Signal |
| 5 | Output, Analog #1 to #4 | Common |
| 6 | Output, Analog #2 | Low Current, + Signal |
| 7 | Output, Analog #1 to #4 | Common |
| 8 | Output, Analog #3 | Low Current, + Signal |
| 9 | Output, Analog #1 to #4 | Common |
| 10 | Output, Analog #4 | Low Current, + Signal |
| 11 | Output, Analog #1 to #4 | Common |
| 12 | ---------- | Chassis Ground |
| 13 | Output, Analog #5 to #8 | Common |
| 14 | Output, Analog #5 | Low Current, + Signal |
| 15 | Output, Analog #5 to #8 | Common |
| 16 | Output, Analog #6 | Low Current, + Signal |
| 17 | Output, Analog #5 | Common |
| 18 | Output, Analog #7 | Low Current, + Signal |
| 19 | Output, Analog #5 to #8 | Common |
| 20 | Output, Analog #8 | Low Current, + Signal |
| 21 | Output, Analog #1 to #8 | Common |
| 22 | ---------- | Chassis Ground |
| | | |

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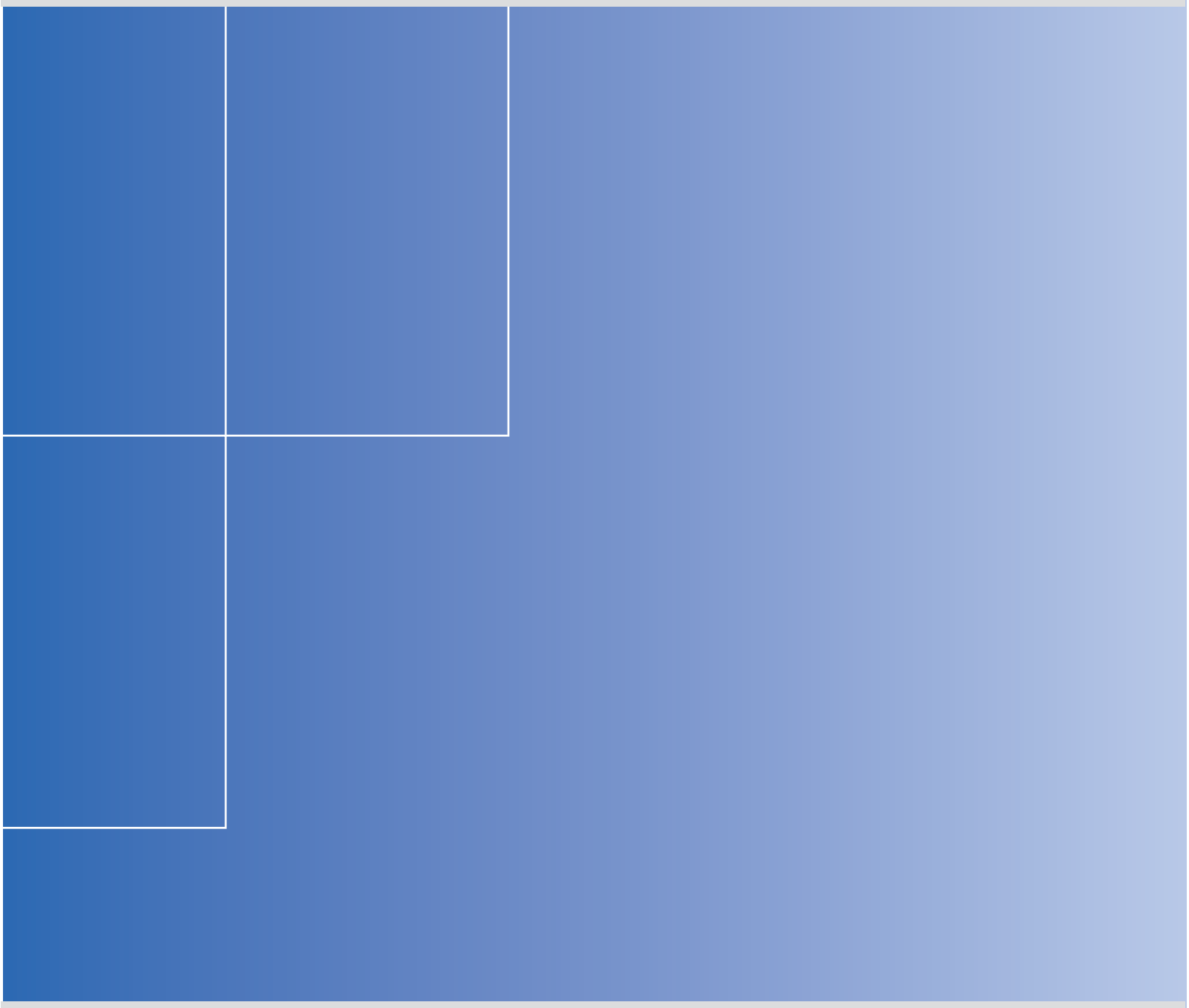

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